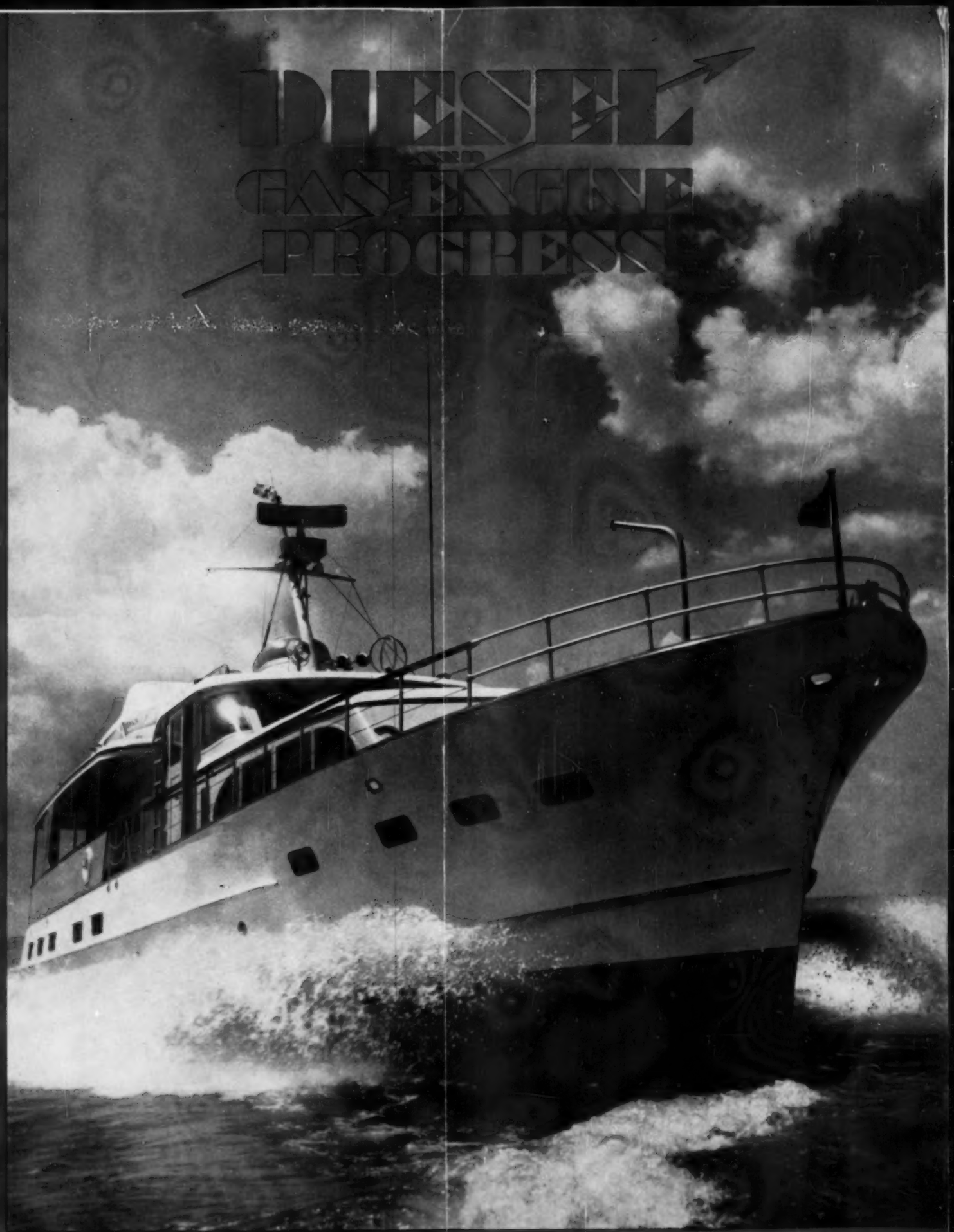
DIESEL and GAS ENGINE PROGRESS

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES



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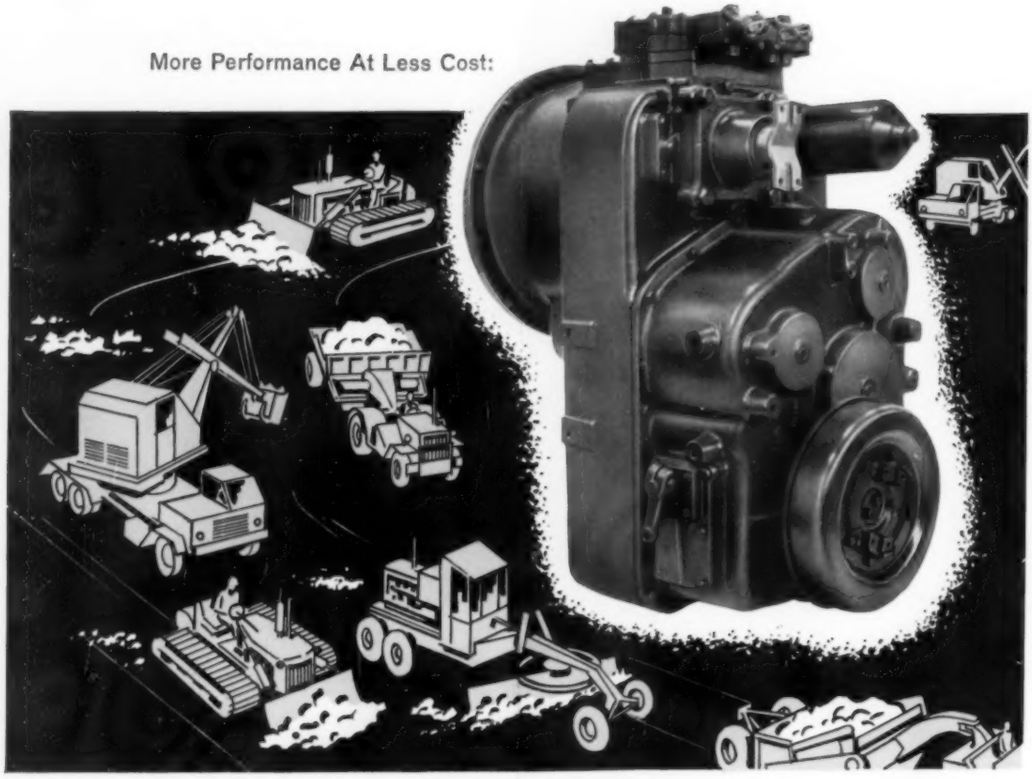

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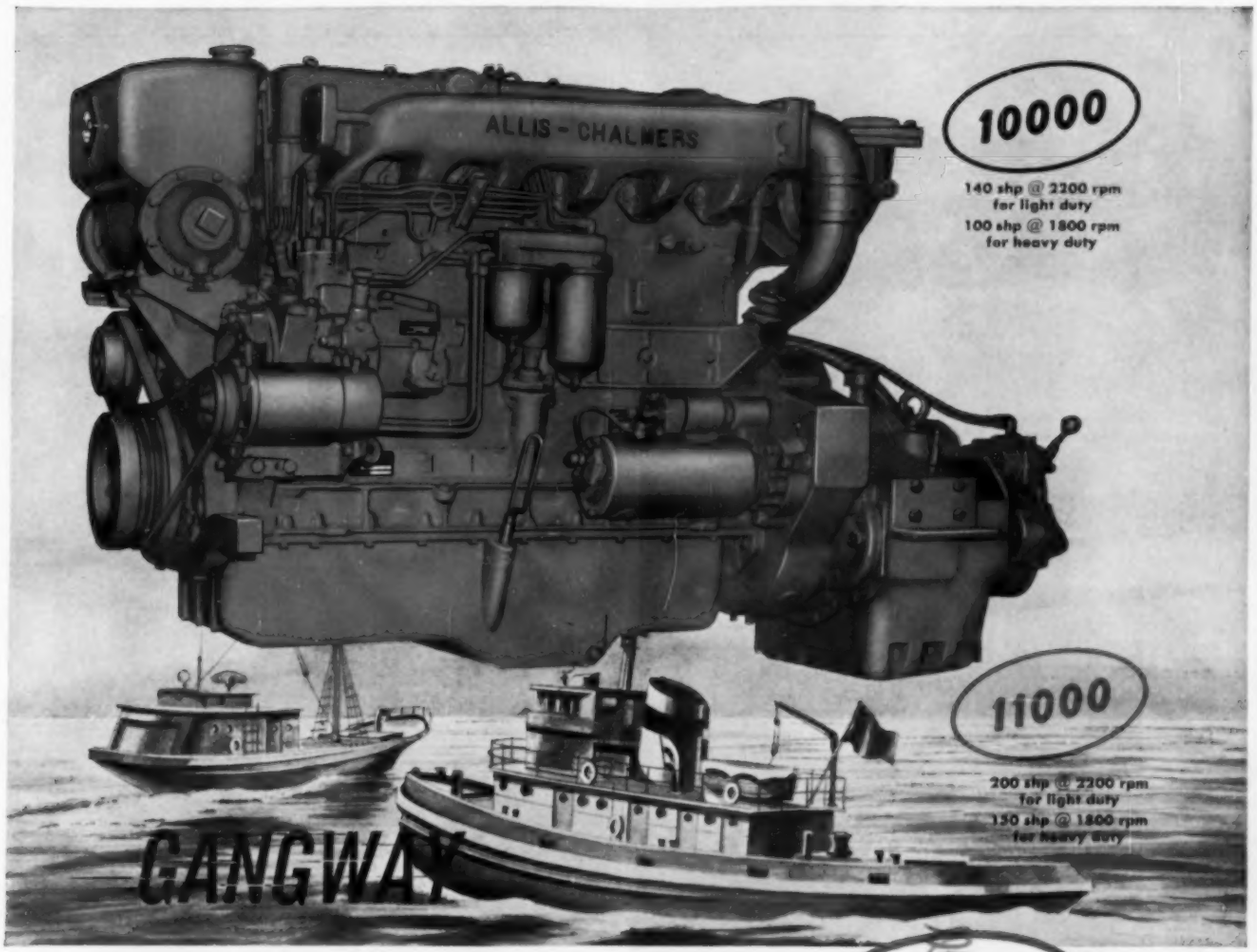

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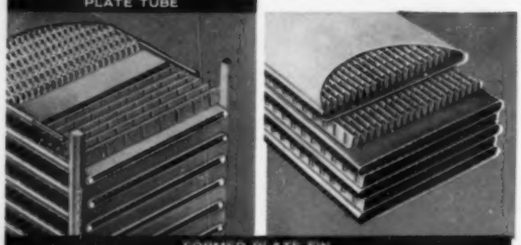
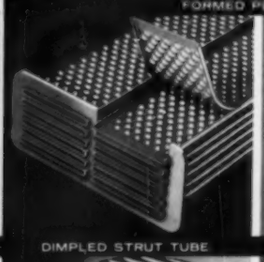

FORMED PLATE-FIN

DRAWN CUP

WIRE WOUND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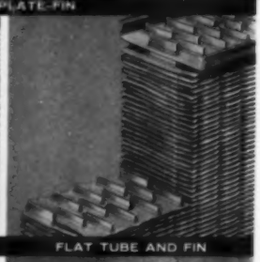
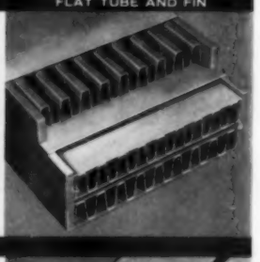
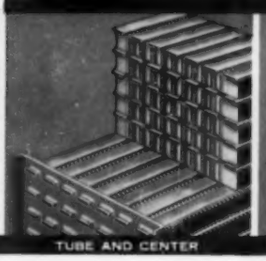

FLAT TUBE AND FIN

ROUND TUBE AND FIN

BAR AND PLATE



CORRUGATED FIN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CONTENTS FOR JANUARY, 1961

What's New in Towboats for 1961? 21
Marine Gear Advances Keep Pace With Demands 25
M/V America Adds 9000 HP to Federal Barge Lines Fleet 26
Aluminum *Jigmil IV* Has 900 SHP 29
Three Versatile, Low Cost Fireboats for Baltimore 30
Twin 340 HP Units Power Panther 32
Halibuter Ups Profits With Extra Horsepower 32
Water Turbines Propel New Jet Boat 34
Turbocharged Diesels Give Range and Speed to New Yacht 36
Another Look at Small Diesels for Smaller Trucks 38
Design and Application of Piston Rings for Large Engines 41
1,000,000 Miles Prove Diesel Economy in Detroit Taxicabs 44
RT-248 Jet Driven Gas Turbine Now in Gas Pipeline Operation 46
Cottonseed Processor Trims Costs, Boosts Output with Change to Diesels ... 48
Diesel Service Progress 50
V-8 Engine Helps Speed Alaska Run 52
Off-Road Unit With Power Shift 69
New Graded Density Filter for Fuel and Lube Oils 69

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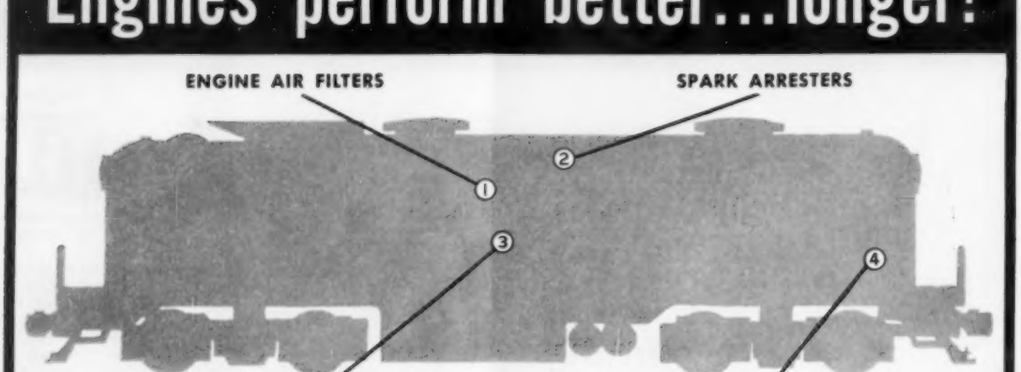

Whether you or the manufacturer rebuilds your locomotives, be sure to specify and use Air-Maze filtration products. Thirty-five years of filtration experience assures the Railroad Industry of maximum performance.

The following are examples of the variety of Air-Maze filtration products for diesel locomotives

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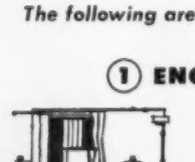
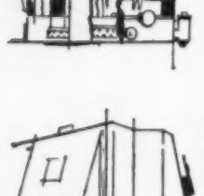


OIL BATH filter removes up to 97% of objectionable dirt . . . requires only semi-annual oil changes and annual cleaning.



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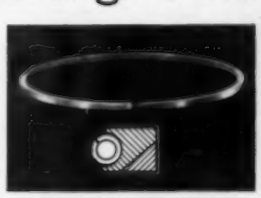

CRANKSHAFT SEALS: Application of a conformable step seal ring (specially designed for Caterpillar) establishes a *permanent* crankshaft seal, reliable for the life of the engine.

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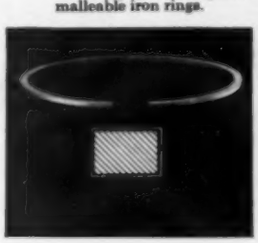

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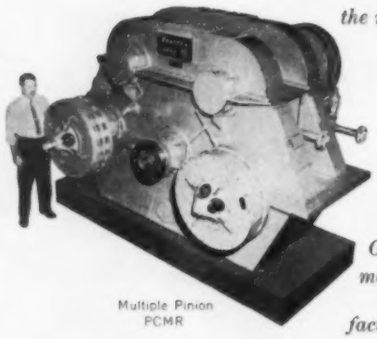

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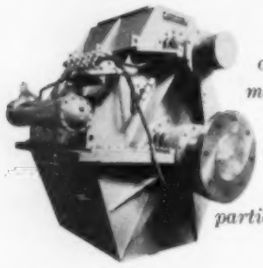

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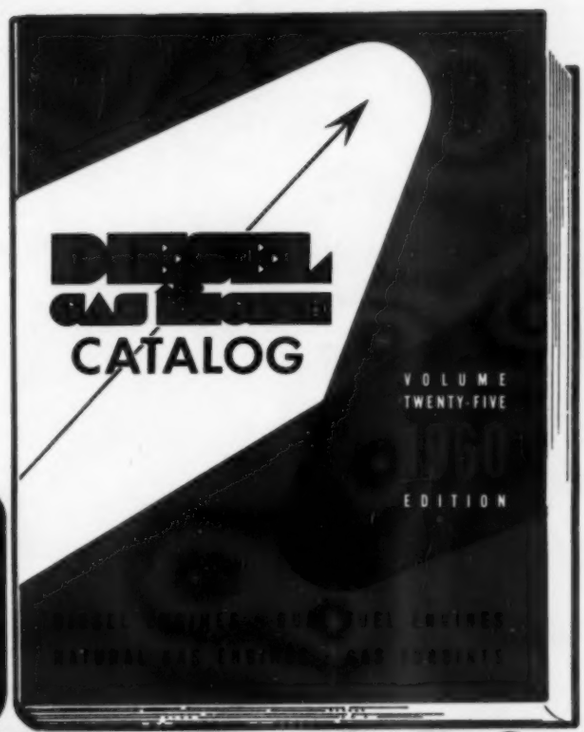

LOOK AT THE CONTENTS!

1. ENGINES — All major manufacturers of diesel, dual fuel, natural gas engines and gas turbines are represented in multiple page sections. Text is supplemented with specifications, power curves, photographs and sectional views.

2. TURBOCHARGERS and SUPERCHARGERS — This section of manufacturers is detailed and fully illustrated to give complete information on this increasingly important phase of the industry.

3. TRANSMISSIONS — The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section

4. ACCESSORY EQUIPMENT — Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.

5. ADVERTISING — Leading manufacturers of engines, accessories, and services bring out the important features of their products in attractive, easy to read advertisements to further enhance the reference value of the CATALOG.

6. PLUS A LARGE GAS TURBINE SECTION

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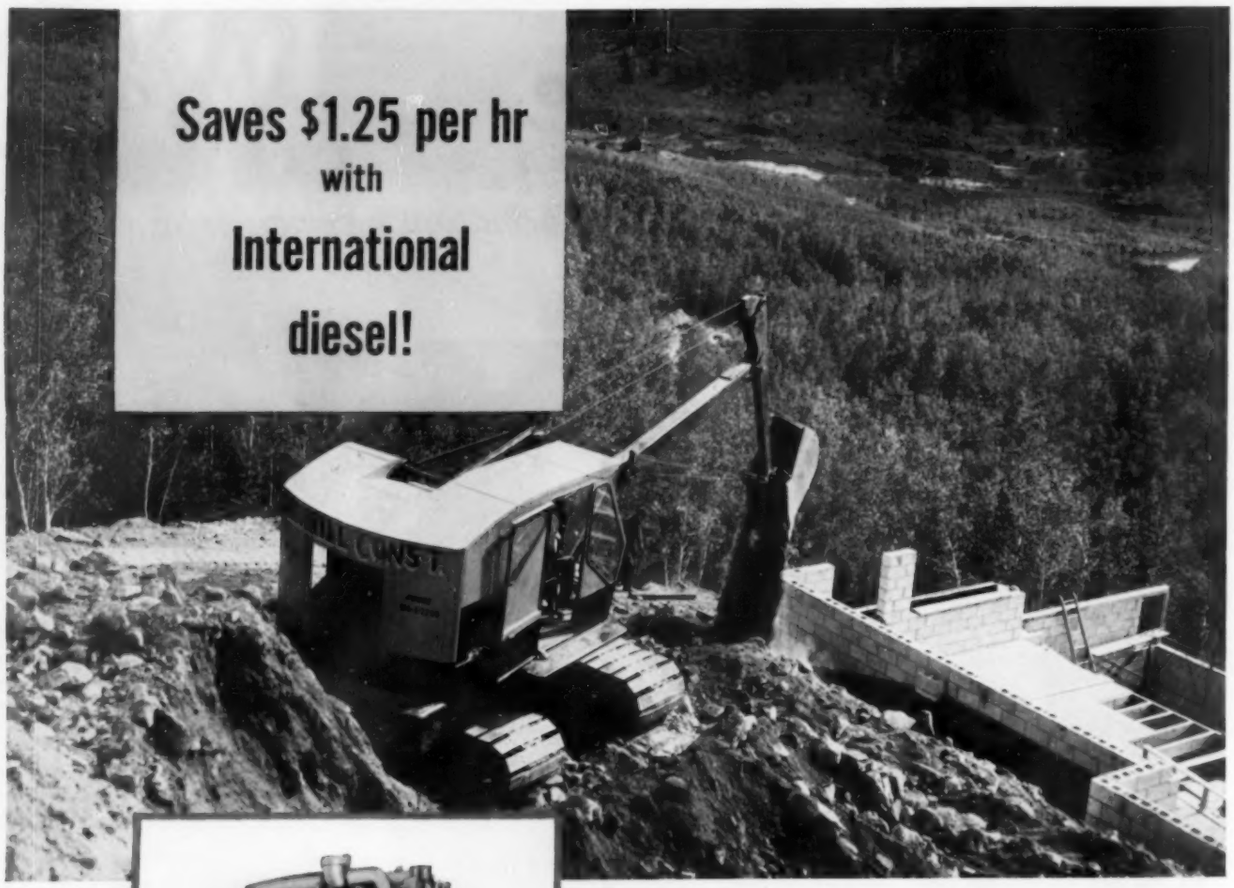

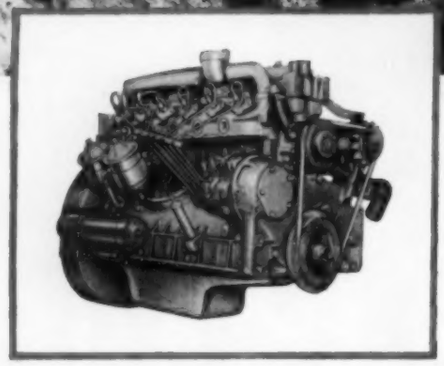

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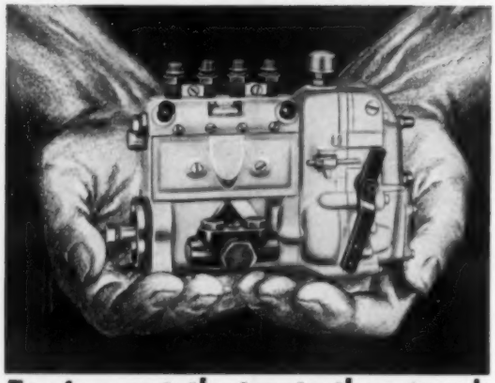

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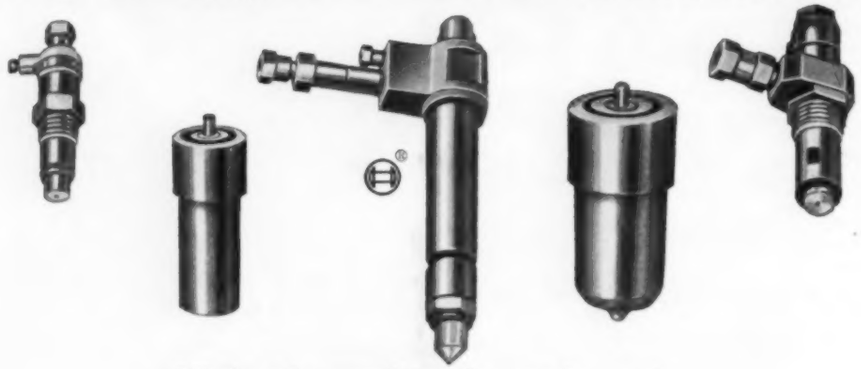

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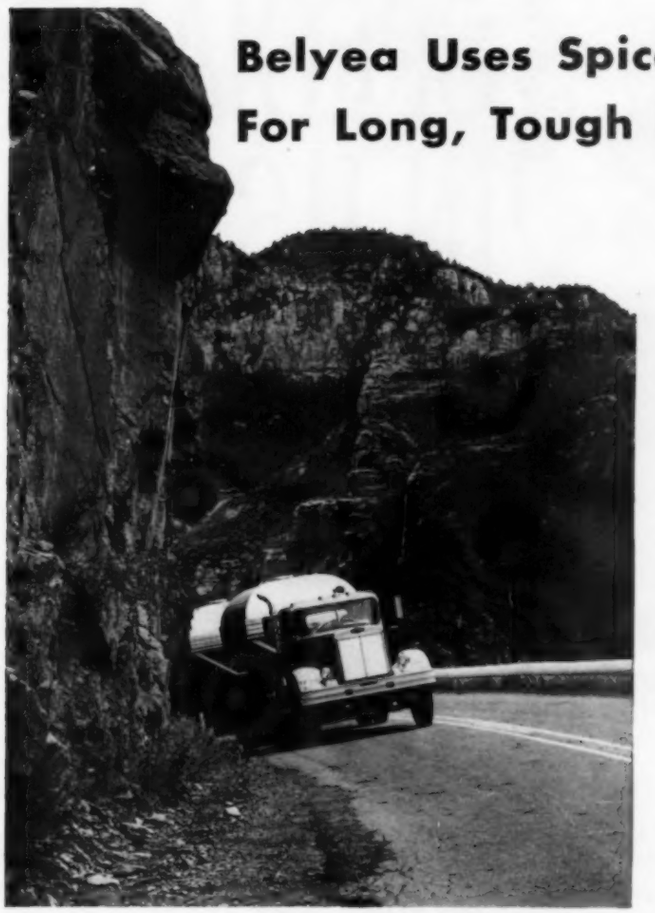

Part of a fleet of special Belyea tractor-trailer combinations whose grueling mountain haul is proving the efficiency and stamina of Spicer components.

John Sutherland, maintenance superintendent for Belyea's Glen Canyon Operation, checks one of the Spicer transmissions in the Belyea fleet.

High in the mountains of Arizona, Belyea Truck Company, of Los Angeles, is operating a fleet of Autocar trucks equipped with Spicer transmissions, clutches and universal joints on a rigorous haul which is dramatically proving the rugged, built-in quality of Spicer components.

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John Sutherland, Belyea's maintenance superintendent, reports that the Spicer components are taking the heavy loads, steep grades and wide temperature variations in their stride – proof again that Spicer's engineering skill and precision manufacturing result in reliable performance, longer service. The transmissions are Model 8245 4-speed units with Model 8345-A 4-speed auxiliaries. 14" 2-plate clutches and 1700 Series universal joints make up the other Spicer equipment.

For further information, write Dana Corporation, Toledo 1, Ohio.

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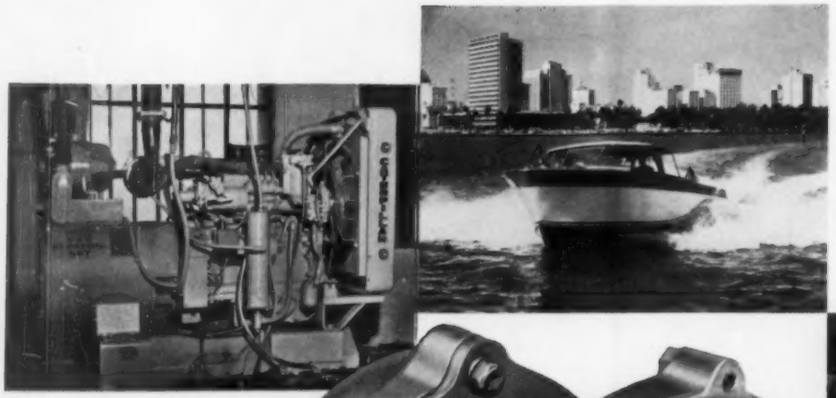

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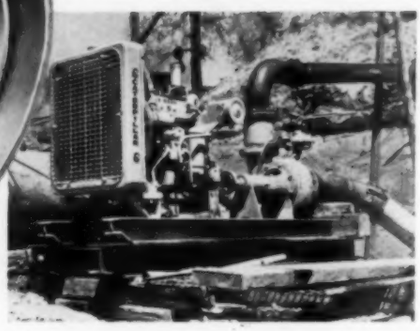

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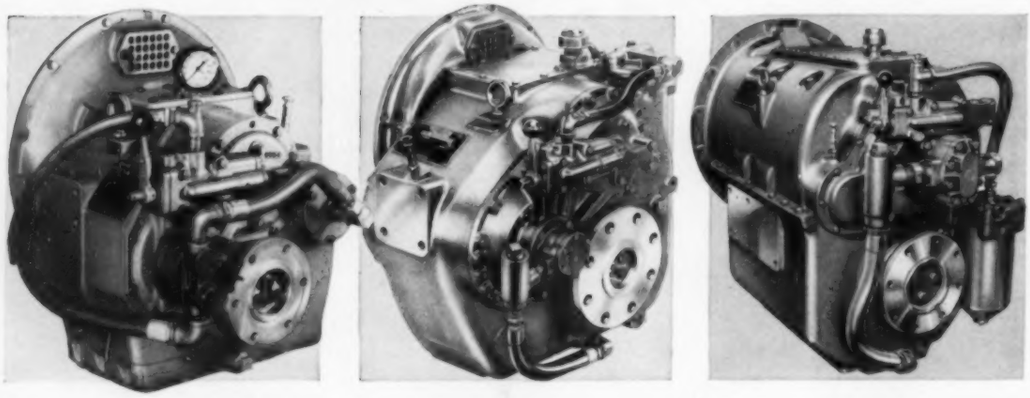

NEW MG-508

A smaller version of the MG-512 with the same features that have made the MG-512 the largest-selling gear in its class. Three optional driving rings permit easy replacement of older model Twin Disc gears (including the war surplus X8708) without flywheel change. Ratios—1.47:1, 2.04:1, 2.95:1 and 3.39:1.

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General Electric's new U25B, 2500-horsepower mainline diesel freight locomotive with Bendix diesel fuel injection system.

BENDIX DIESEL FUEL INJECTION HELPS NEW LOCOMOTIVE DELIVER AMERICA'S HIGHEST H.P. PER AXLE

General Electric's newest diesel-electric locomotive, the U25B, is the largest and most powerful in G. E.'s universal line. The locomotive is built on four axles; its diesel engine, manufactured by Cooper-Bessemer to G. E. specifications, enables it to deliver 625 h.p. per axle.

Seven years in development, a two-unit U25B prototype has seen over 200,000 miles of demonstration service on numerous lines, and is now in operation on midwestern roads.

This new giant of the rails is 60 feet, 2 inches long and weighs 130 tons. It was designed for both speed and economy in mainline freight service. In addition to high horsepower, it features operational simplicity.

Among the engine's modern design features is a Bendix® diesel fuel injection system. The Bendix pumps are installed at the upper part of each cylinder to shorten the high pressure lines to the injectors, thus providing more efficient, dependable fuel flow.

Bendix fuel injection systems equip many other G. E. locomotives, including the auxiliary diesel engine on the world's most powerful locomotive, the 8500-h.p. gas turbine built by G. E. for Union Pacific.

Diesel engine manufacturers are turning to Bendix in increasing numbers when complete dependability and operating economy are main considerations. In addition to Bendix fuel injection systems, Bendix ignition systems are also used in railroad service. We will be glad to supply detailed information on Bendix fuel injection or ignition systems. Write: Scintilla Division of The Bendix Corporation, Sidney, New York.

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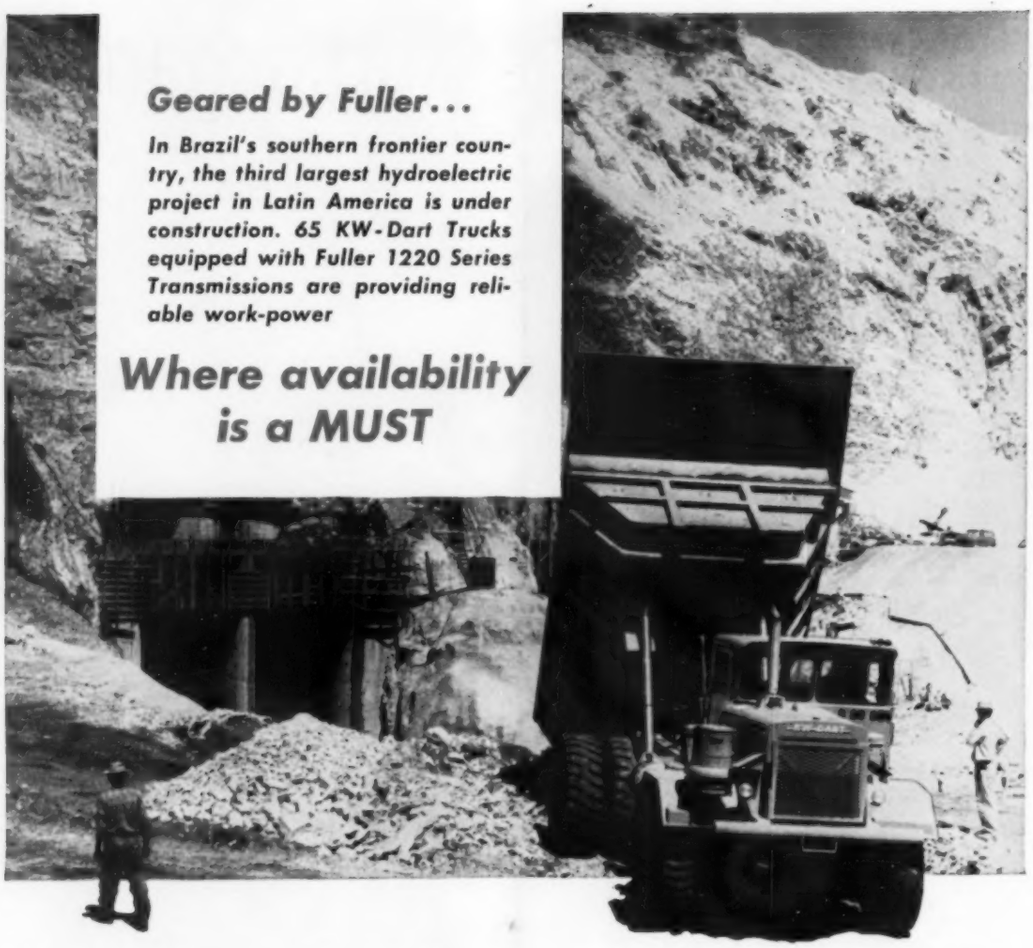

Geared by Fuller...

In Brazil's southern frontier country, the third largest hydroelectric project in Latin America is under construction. 65 KW-Dart Trucks equipped with Fuller 1220 Series Transmissions are providing reliable work-power

Where availability is a MUST

To harness much of Brazil's tremendous water power potential, Central Eletrica de Furnas is building a 400-foot-high dam across the Rio Grande River. Completion date for the dam, which will create a reservoir 150 miles long, was originally set for 1965, but an earlier finish is now in sight.

Contributing greatly to the accelerated construction schedule are 65 Fuller-geared KW-Dart Trucks used on the project. 55 of the KW-Darts are Model 25SL, 25-ton dump trucks equipped with 320 hp diesel engines and Fuller 10-F-1220 10-speed Transmissions. The remaining ten are heavy-duty KW-Dart Diesel Tractors, seven of which are equipped with 10-F-1220s and the other three with Fuller 5-F-1220 5-speed Transmissions. The tractors are used to transport cement and move heavy equipment.

Working more than 6,000 miles from Kansas City, Mo., where they were built, the trucks were selected because of the dependability of their component parts. Reports from the project site indicate that the heavy-duty Fuller Transmissions in the mountain-moving fleet have been instrumental in the trucks' excellent record of performance and availability on one of the world's most dramatic construction jobs.

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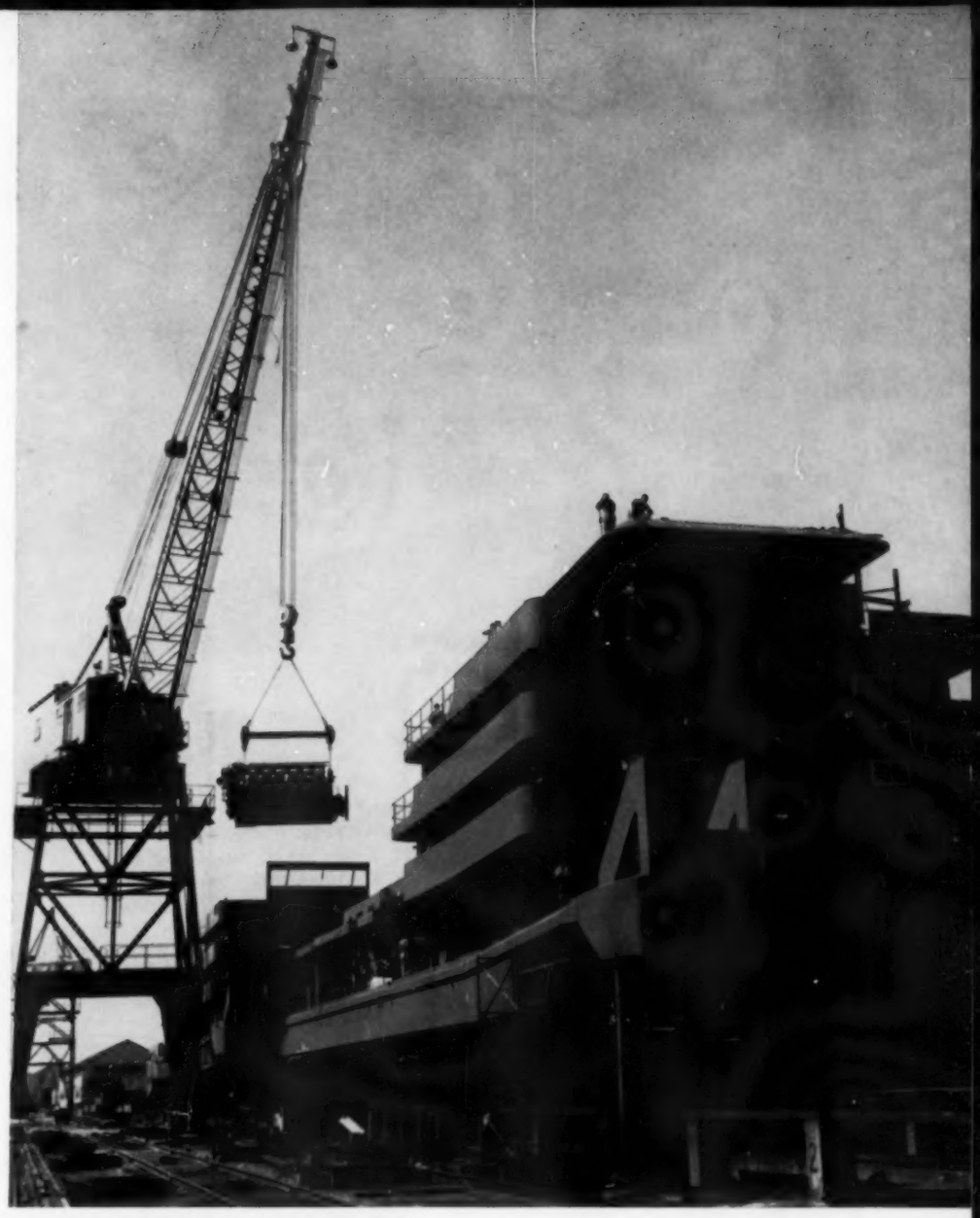
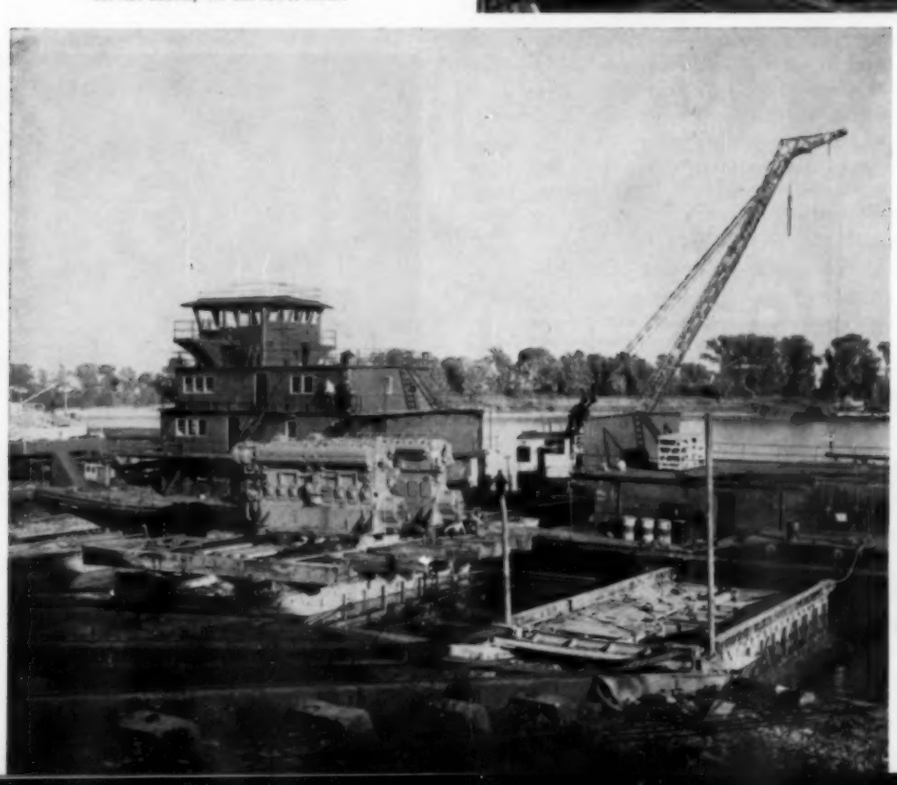
WHAT'S NEW IN TOWBOATS FOR 1961?

TOWBOAT building in this country, while not setting too heavy a pace currently, moved fairly briskly during the past year as the builders kept pace with the clear-cut trend on the inland waterways to higher horsepower boats and larger tows. This surge in large towboat building, it is believed, will have a marked influence on the industry's plans for the next twelve months as the "big boats" enter service and start chalking up their anticipated operating economies.

Before we look at some of the new boats in detail, let's consider the inland waterways industry overall. Commenting is Braxton B. Carr, president of The American Waterways Operators, Inc., who in an exclusive report to this magazine, states: "As the inland waterways industry of the United States enters the new decade, it does so with determination and unity of purpose—determination to fight for its place as an independent partner in a balanced transportation system. The industry has made extraordinary progress in recent years. In 1945, for instance, the inland waterways (exclusive of the Great Lakes) accounted for three per cent of the nation's total transportation traffic. Today it accounts for nine per cent. Last year an estimated 389 million tons of commerce were transported on the 29,000 miles of inland waterways.



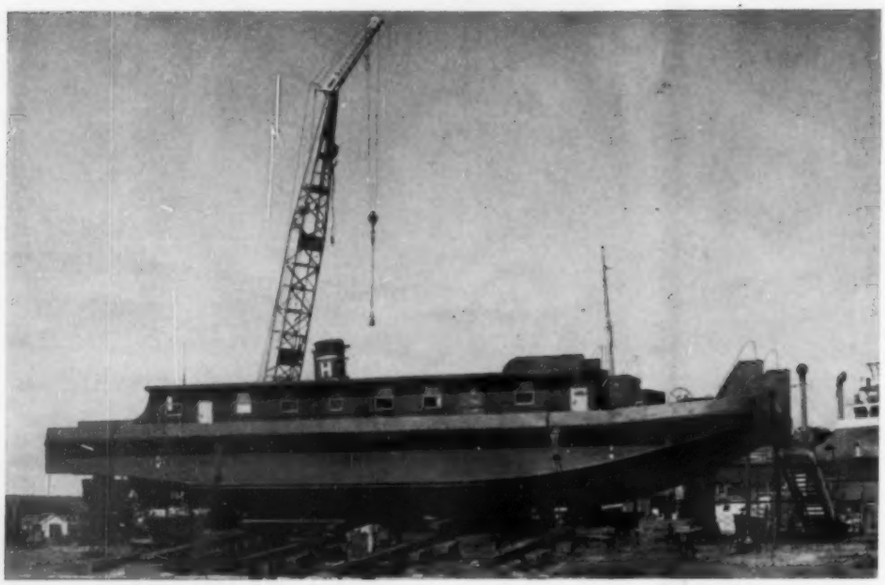
A 12 cylinder Alco diesel being lowered into the engine room of the *Patrick Calhoun Jr.*, first of two large towboats constructed at Jeff Boat for American Commercial Barge Lines. The two large 190 ft. boats will enter service shortly on the lower river.



(This is exclusive of the Great Lakes.) This is a 5.8 per cent increase over the 366.5 million tons carried in 1958. Principal commodities and their tonnages transported in 1959 included: petroleum and petroleum products, 134 million tons; bituminous coal and lignite, 86.7 million tons; sand, gravel, crushed rock, 52 million tons; unmanufactured sea shells, 22.2 million; logs, 21.3 million; iron and steel products, 7.5 million; chemicals, 9.4 million; and grains, 7.7 million. The most significant increases in tonnages occurred on the Ohio River, up from 73,476,894 to 80,801,017; on the Mississippi, up from 75,279,676 to 80,237,363; and on the Gulf Intracoastal Waterway, up from 46,007,718 to 51,305,641.

"There are approximately 1,700 firms employing

Work on the *Austen S. Cargill* was progressing rapidly when this picture was taken at St. Louis Shipbuilding & Steel Co. The vessel built for Cargill Inc. entered service in late 1960. Two of the three 2210 hp Cooper-Bessemer diesel propulsion engines stand ready for installation.



Myrtle C, new 105 ft. twin screw GM Cleveland Diesel propelled towboat on launching ways at Christy Corp. Shipyard. Towboat is in charter service by S & S Towing of Joliet.

about 80,000 operating personnel aboard the inland waterways fleet of 20,038 vessels. This includes 4,215 towboats, 13,485 dry cargo barges and 2,338 tank barges. The cargo capacity of the inland fleet now stands at 14.5 million net tons. Another heartening sign has been the continuing evidence of the attraction of waterside sites for industrial plant locations. At the three-quarter mark in 1960, the total number of new facilities or expanded facilities on waterside sites stood at 181 for the year. This brought to 3,379 the total number of new waterside sites constructed since the American Waterways Operators, Inc., began keeping records on this activity in 1952. Moreover, 64 of the 181 new facilities constructed in the first nine months of 1960 were terminals, docks and wharves designed for handling barge traffic.

"One can see, therefore, that the future of the inland waterways industry can be a bright one. Transportation costs represent 20 per cent of our national income and freight transportation services are increasing at a rate faster than the total national production of goods and services. There is no indication, moreover, that there will be any deceleration in the years ahead. On the other hand, if our economy continues in a normal growth pattern in this country, we can anticipate the need for added freighting services, including added services by the shallow-draft water carrier industry. This industry was virtually wiped out 100 years ago. It has come a long way since and, with our modern technology, has by no means reached its full potential. Ours has been a growth industry. It can continue to be a growth industry, making an important contribution to the standard of living of all Americans, provided no artificial barriers are placed in the path of its growth."

With the emphasis solidly on higher horsepower towboats—floating marine power plants that move more cargo faster at less cost per ton—it's interesting to note the comment of an official of a major operating company. "The need for boats capable of handling greater payload has been apparent for sometime, however only in the last several years has technology both in vessel and propulsion equipment design made this move desirable from an operating cost viewpoint." This statement in a great measure reflects the ability of the diesel engine manufacturers to adapt their higher horsepower and highly efficient engines to the rigorous requirements of towboat service, especially considering factors of operating flexibility, good economy on marine or lower grades of fuel oil, lower maintenance and less downtime. Coupled to these factors, are the more simplified, more dependable control, gearing propulsion systems, and other auxiliaries and accessories now available. These new towboats are setting and will continue to set standards of efficiency and lower cost of moving goods on the waterways that will make it incumbent on operators of less modern equipment to measure up by extensive repowering or building of new towboats if they are to remain competitive.

Underlining the move to the larger boats was the christening in October of the *M/V America*, a 9000 hp, 184 ft. four-decker that is known as the world's "largest and most powerful". Built by St. Louis Shipbuilding & Steel Co. for its barge line subsidiary, Federal Barge Lines, the *America* is fully described in a feature three-page article in this January issue. The new towboat joins its 8500 hp FBL sistership *M/V United States* in service in lower river traffic.

Due for christening as this article is written, is the *Patrick Calhoun, Jr.*, first of another mighty pair of towboats, these being built by Jeffersonville Boat and Machine Co. for its parent company, American Commercial Barge Lines. The *Calhoun*, together with its sistership launched recently, are primarily intended for work on the Mississippi River, from St. Louis to New Orleans, but may also ply the Ohio from time to time. Each boat is 190 ft. long, 48 ft. wide with a draft of 9 ft. and has the capability of pushing 30 or more barges containing 40,000 tons of cargo.

The new twin-screw river giants are each powered by a pair of Alco Products 12 cylinder, 9 x 10½ in. bore and stroke, model 251B marine diesels per shaft. These four-cycle turbocharged engines carry a continuous rating of 1655 bhp at 1000 rpm with an overload rating of 1800 bhp at 1000 rpm through a rotary type of rack stop. Each pair of engines drives a four-blade, 144 in. dia. propeller at 180 rpm in a Kort nozzle through a twin pinion

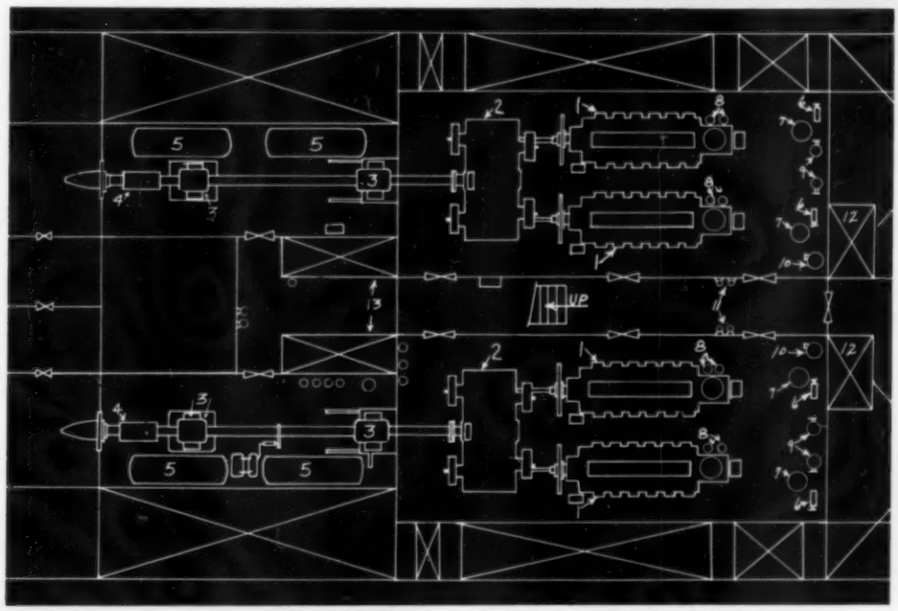
Outboard profile of one of the two new Midland Enterprises, Inc. towboats being built for Ohio River service. The twin screw vessels are powered by Fairbanks-Morse 1920 hp diesels.

Installation of two of the four Alco marine diesels aboard the *Calhoun*. Gear and pneumatic clutches are shown under plastic wraps to right.

Western Gear Sea Master model 112PCMR-TP-C reverse-reduction gear equipped with Wichita air clutches. Direction of rotation and engine speed is controlled by Westinghouse Air Brake pneumatic marine controls with a single pilot house control lever for each pair of engines.

An interesting feature is that each engine drives through a 3⅜ in. dia. quill shaft directly connected to the engine flywheel and each input pinion of the reverse-reduction gear. Each engine is equipped with a solenoid-operated air starting valve which admits 80-150 psi starting air to an Ingersoll Rand 20 MB air starting motor. The Westinghouse pneumatic controls are so arranged that an engine may be started, while the other engine on the shaft is running, and engaged to the propeller by simply returning the speed control handle to neutral, then advancing to whatever propeller speed is desired. Each engine room engine-control panel is so interlocked that the Western reverse gear auxiliary motor-driven lube-

A. L. Nash, pusher-type tug, repowered with three GM 12V-71, 340 hp diesel engines supplied by Stewart & Stevenson Services in Houston.



Plan view of propulsion machinery in the *Patrick Calhoun, Jr.* 1. 1635 hp Alco diesel; 2. Western compound reverse-reduction gear with Wichita clutches; 3. Line shaft bearing; 4. Tail shaft bearing; 5. Starting air tanks; 6. Lube oil coolers; 7. Lube oil filters; 8. Lube oil strainers; 9. Jacket water coolers; 10. Raw water pumps; 11. Lube oil transfer pumps; 12. Day tank; and 13. Lube oil storage tanks.

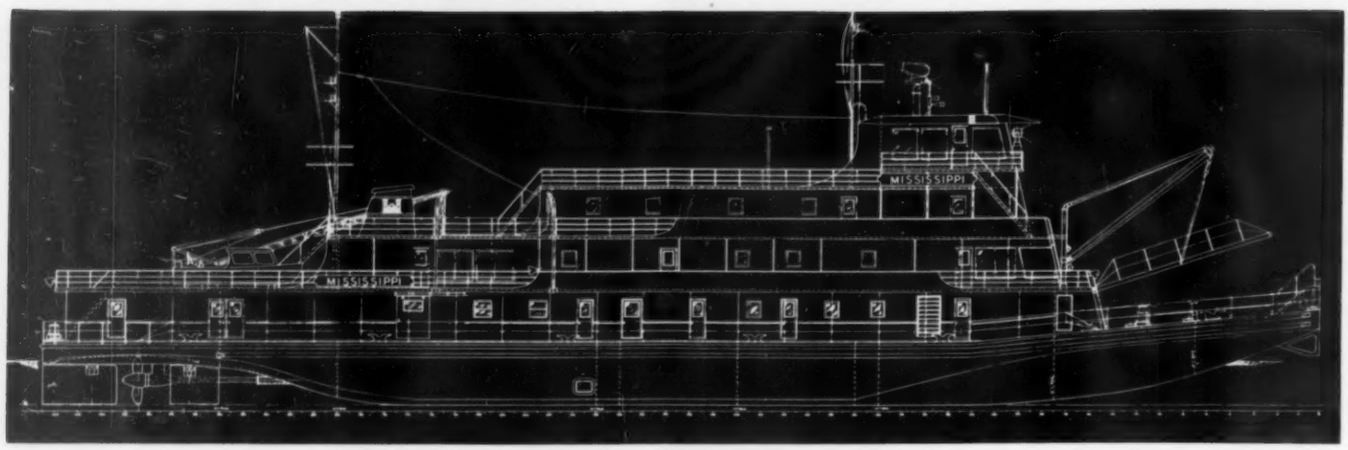
oil pump must be energized before the engine-starting button can become energized.

Each of the 12 cylinder Alco 251 engines, for these boats, averaged less than .369 lbs./bhp/hr. specific fuel consumption during the two hour full load ABS certification test runs at Alco's Auburn, N.Y. plant. In addition to the other regular production testing, each engine demonstrated a half hour test run at full load torque, and constant bmep at 70 per cent of full engine speed with an average fuel consumption of .373 lbs./bhp/hr.

Back at St.-Louis Shipbuilding & Steel Co., work is progressing on three additional large towboats—the *M/V Austen S. Cargill*, a 182 footer for Cargill, Inc.; and two 164 ft. Ohio River boats for Midland Enterprises, Inc. The *Austen B. Cargill* is unique in that it is a triple-screw towboat with power on each shaft supplied by a Cooper-Bessemer LS-8DRT turbocharged direct-reversing diesel rated 2210 hp at 350 rpm and driving through Western Gear Sea Master reduction gears with a 1.64:1 ratio. The starboard wheel turns left-handed and the other two, right. In projected service, the *Cargill* will operate on the lower Mississippi with grain as its main cargo downbound, and salt, fertilizer, chemicals and other bulk commodities upbound. Estimates are that the 6600 hp vessel will be capable of towing up to 32 jumbo barges. The two new Midland Enterprise boats are twin-screw measuring 164 x 40 x 11 ft. and will each be powered by Fairbanks-Morse model 38D8 ⅛ diesels. Rated 1920 hp at 720 rpm, the F-M engines will swing 109 in. wheels at 180 rpm with drive through Western Gear PCMR-B reverse and reduction gears.

Also in the 6000 hp class are two new 190 ft. boats now being built by Dravo Corp. at its Neville Island shipyard for Union Barge Line Corp. These twin-screw vessels will each be propelled by Nordberg four-cycle, turbocharged V-type Supairthermal marine diesels. Each engine is rated at 3200 bhp at 515 rpm and will drive through Western reverse and reduction gears and Wichita clutches. Union Barge Lines is now operating eleven diesel towboats and the two new vessels will be the largest in the fleet. According to L. P. Struble, Jr., UBL president, the 6000 hp boats will operate primarily on the lower river.

Down at Pascagoula, Miss. in the Ingalls Shipbuilding Corp. yard another modern, twin-screw towboat is being constructed—this for the U.S. Army Corps of Engineers. This towboat, the fourth to bear the name *Mississippi*, has a length overall of 217 ft. and will be powered by two



Inboard profile of the new Corps of Engineers towboat *Mississippi* which will be powered by a pair of Nordberg 1860 bhp non-reversing marine diesels driving controllable pitch propellers.

Nordberg 1860 hp, 500 rpm, eight cylinder four-cycle turbocharged diesels. The engines drive through a Lufkin 2.0833:1 reduction gear to Liaane-Wegner servo-hydraulic controllable and reversible pitch propellers. The new *Mississippi* has been specified to operate under a wide range of conditions. As a towboat it will be required to handle tows of not less than 15,000 short tons gross, and as an inspection boat without tow to attain a still water speed of not less than 15 mph.

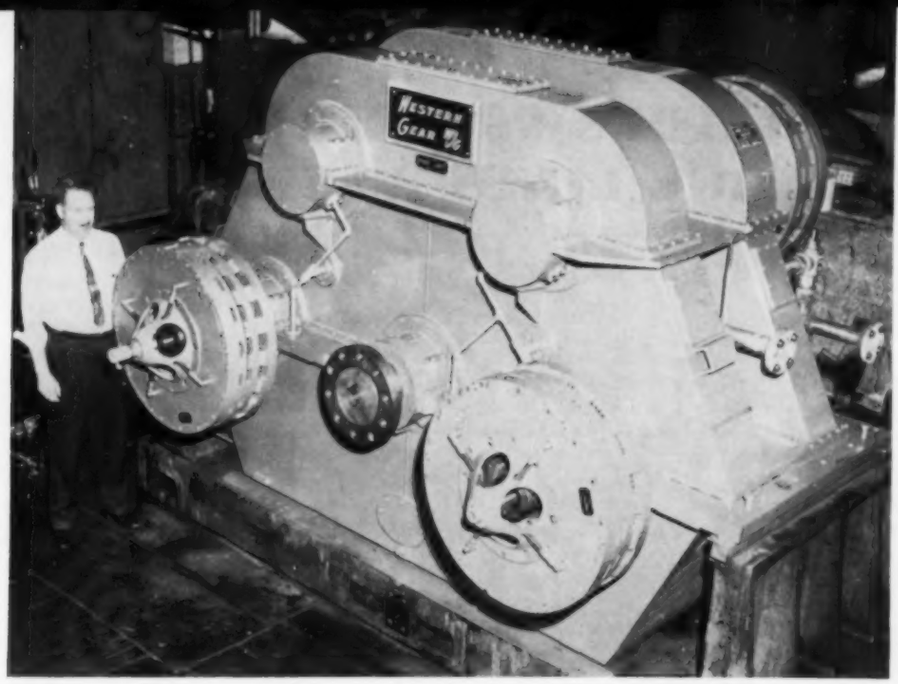
Shifting to smaller boats now, let's look at three vessels—two new ones and another recently repowered. Just entering service is the *Myrtle C*, a 105 ft., 1800 hp twin screw towboat built by Christy Corporation for its own account and now chartered to the S & S Marine Towing Co., Inc. of Joliet, Ill. for operation on the Mississippi and Ohio Rivers. Principal characteristics for the towboat are 105 ft. in length, 30 ft. beam, with a depth of 10 ft. Twin propellers are driven by two 900 hp. 12-567 ATL GM Cleveland diesel engines driving two cast steel, four-blade propellers. The new vessel has a retractable pilot house with a maximum range from lowered to raised position of 8 ft. 8 in. The engines are cooled by skin coolers. The diesel fuel tank capacity is large for a vessel of this kind, having a total capacity of 36,000 gallons. All engineering for the construction of this vessel was handled by A. M. Deering & Son of Chicago, Ill.

An excellent example of marine craft rejuvenation is incorporated in a pusher-type tug owned by H. W. A. Harms and Son, which is plying the waters of the Houston Ship Channel and Intracoastal Canal with new vigor. Originally a single screw tug, the *A. L. Nash* is now power laden with three GM 12V-71 diesel engines furnished and installed by Stewart & Stevenson Services. The Houston-based company had installed one 340 continuous horsepower V-12 engine adjacent to the original diesel. However, the Nash ran aground, the base on the old unit was broken and repair costs would have been $26,000. It was then that a second V-12 was installed on the old engine's foundation. Only recently, a third V-12 was added.

The engines have Twin Disc, MG-512, 6:1 ratio reduction gear with deep case and each V-12 develops 340 continuous horsepower, maximum rating on each being 504. The engines turn three 64 x 44 four-blade propellers and under full load the Nash has been clocked at 7 mph. The engines are equipped with air starting motors, and complete wheel house controls eliminate the need for engine room control since the vessel can be completely manuvered, as well as started and stopped, from the wheel house.

***M/V Bill Wolter*, new Cairo junction shuttle boat, is powered by Caterpillar D-375 diesels equipped with Twin Disc MG-521 reverse-reduction gears.**

A good number of new shuttle boats have been going into service at the Cairo junction and higher horsepower is a dominant factor for this class of river work as well. One of the newest boats is the *M/V Bill Wolter*, a 55 footer recently completed by St. Louis Ship for Cairo Terminal and Fleeting Co. The *Bill Wolter* is powered by a pair of Caterpillar D-375 Roots blown marine diesels that each deliver 300 hp to the 56 in. dia. four-bladed propellers. Drive is through Twin Disc MG-521 reverse and reduction gears with a 4.09:1 ratio to reduce the engines' 1225 rpm's to 300 at the wheels. Engines and gears are controlled from the pilot house by Morse mechanical system. A hydraulic type system controls the backing and steering rudders with mechanical follow-up controls also being employed.



One of four Western Gear PCMR combining reverse-reduction gears built for installation on two new 6400 hp twin screw river towboats. The Wichita air clutches are externally mounted and independently supported to provide accessibility and eliminate misalignment as a clutch wear factor.

MARINE GEAR ADVANCES KEEP PACE WITH DEMANDS

By DWIGHT P. ROBISON

WITHIN recent years, new demands have been made of the marine gear industry to design and produce units that will keep pace with propulsion trends in the shallow draft boating industry. Development of better horsepower absorption characteristics of propellers, resulting lower wheel speeds, and greater horsepower requirements have all been dominant factors. In new vessels of this type, the reverse-reduction gear is gaining increased application. Speed, dependability, maneuverability, and low maintenance costs have been the primary reasons for this trend.

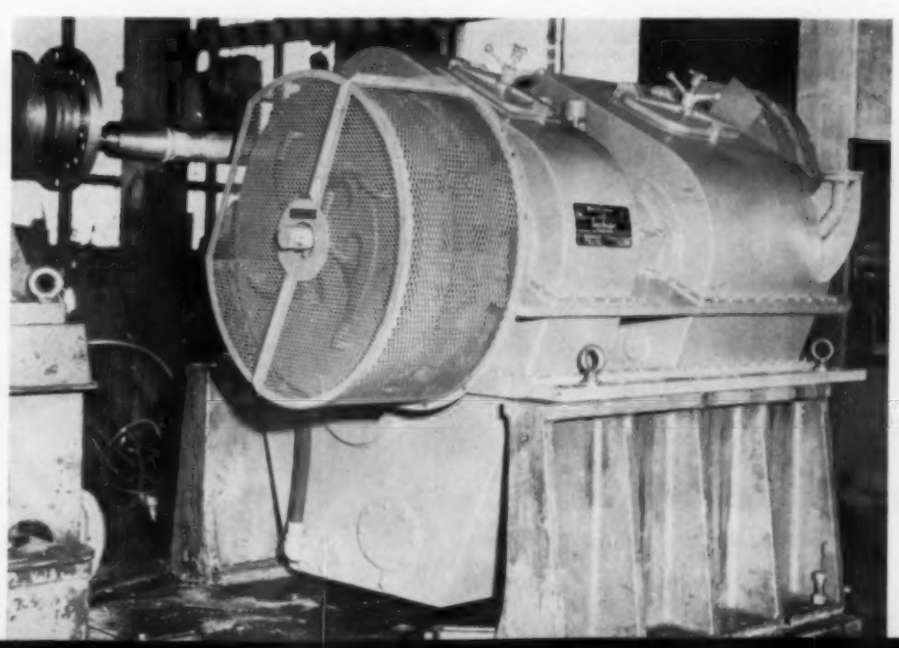
At the outset in the gear development program, considerable attention was given to clutches since first cost, reliability and service costs of these units are key factors. The gear arrangement was also important insofaras giving accessibility and proper installation attention to the clutches. Along these lines, a new type reverse gear with completely independent clutch mounting was first installed in the Curtis Bay tugs *Carolyn* and *H. C. Jefferson* in 1959. These gears were 1600 hp units manufactured by Western Gear Corp. and subsequently most of the recent installations in the higher horsepower work boat field, particularly in the inland waterways fleet, utilized this new type gear. A typical unit is illustrated at the bottom of the page and note that the independent clutch mounting is clearly visible. These clutches are manufactured by Witchita Clutch Co. and are of the low intertia, special ventilated, two-plate type. In addition the "quill shaft" input drive as developed by Western Gear can be seen.

The new quill shaft concept solved two difficult problems simultaneously: 1. Misalignment, present in almost every marine installation, was no longer a serious item since the long quill accommodates the normal misalignment encountered without damage to engine or gear; and 2. Torsional vibration is effectively controlled since the quill acts as a torsionally flexible member allowing low frequency tuning of the system. This is generally believed to be the most desirable means of handling the relatively complex gear trains required for reverse and reduction gear drives.

In the February 1960 issue of DIESEL AND GAS ENGINE PROGRESS a detailed description was given of a new combining reverse and reduction gear developed by Western Gear. Since then installations have been underway in two new 6400 hp towboats being built for American Commercial Barge Lines. The lead article in this issue contains a complete description of the propulsion machinery on these boats and the above picture shows a completely assembled gear unit. Construction features of these units include split sleeve journal bearings, Kingsbury thrust bearings, quill shaft drives (which work equally well on twin pinion drives), Wichita airtube clutches, and precision hobbed gearing.

Also of great importance in recent inland waterways and Great Lakes developments are large direct reversing diesels coupled to reduction gears. Four important installations, either underway or recently completed, utilize a new type reduction gear built by Western Gear. Eleven gears, model 300MGV280, have been installed in two quadruple screw and one triple screw towboat built by St. Louis Ship. All are powered by Cooper-Bessemer diesels each rated in excess of 2000 hp—the 8500 hp *United States*, the 6450 hp *Austen B. Cargill*, and the 9000 hp *America*. A story on the latter vessel begins on the next page. The fourth vessel was the M/V *J. R. Sensibar*, an ore carrier modernized, and repowered with a 3200 bhp Nordberg diesel driving a KaMeWa (Bird-Johnson) controllable pitch propeller through a Western Gear 480MGV 240A reduction gear equipped with Wichita clutch. This vessel was completely described in our August 1960 issue.

1600 hp gear for Curtis Bay tugs features quill shaft input drive which solved misalignment problems and enabled effective control of torsional vibration. Clutch is Wichita, low inertia, two-plate type.



M/V *AMERICA* ADDS 9000 HP TO FEDERAL BARGE LINES' FLEET

By LOUIS M. REITZ

WITH more horsepower and greater length than her sister vessel *United States,* the M/V *America* now has the title of "the most poerful river tow boat". Christened on Columbus Day by Mrs. John J. Allen, Jr., wife of the Undersecretary of Commerce for Transportation, the four-wheel super power towboat *America,* coming out less than two years after the *United States,* is ample proof that big diesel horsepower is one of the answers to problems facing towing companies.

The new *America* differs from her sister in that she is 4 ft. longer and has 500 more hp in the engine room. So she will handle better than 42 barges, hauling the equivalent of 10 freight trains of 100 cars each. These boats can actually shove more than that many loads, but pushing power alone is not enough in an efficient towboat. It must have designed into it the ability to *handle* a tow. For it is here that a properly designed hull and rudders allow the pilot to make full use of the torque transmitted by his engines to the wheels. Another way to visualize what the new boat will do in the way of hauling freight is to imagine enough steel "boxes" to cover seven football fields. Load them up to 12 ft. high with such items as grain, steel products, ore, oil, chemicals, fertilizer and even higher with such loads as coal and sulphur and other types of cargo having a steep "angle of repose" and you will have a good idea of the amount of cargo this boat can *handle.*

Statistics show that the sister vessel *United States* moved as much as 3,650,000 ton-miles per day upstream and 7,783,600 down, with a maximum of 35,815 tons of cargo in one tow. Operating on Navy Special or Bunker C fuel effected a saving of about $125,000 in one year in fuel costs, with a minimum of down time.

Costing under $2 million, the *America* is 184 ft. long and 58 ft. in the beam. This unusually wide beam (for a towboat) called for careful after end design to provide optimum water flow to the wheels. This contouring and some changes in the size, location and control of the backing (flanking) rudders will increase the propulsive efficiency about 16 per cent. The above improvements were developed in a recent series of tank tests made at Wageningen, Holland, where the St. Louis Ship "smooth curves" were also developed. The absence of "laps" in the plating on the underside of the hull would cause an old-time river man to say "she's as smooth as a schoolmarm's leg." For power to shore her tows which, together with the boat, will sometimes be longer than the Ocean Queen, *S. S. United States,* she has four intercooled and turbocharged LS-8-DRT Cooper-Bessemer direct reversing marine diesel engines. These slow speed marine diesels are well known for their ability to operate efficiently on low grade fuel. Vapor Phase Systems by Engineering Controls permit the use of residual fuel in the four main engines, which have (each) eight cylinders of 15½ in. bore and 22 in. stroke. Developing 2,250 hp at 327 rpm each engine drives a 108 in. propeller through a Western Sea-Master model 300MGV280 reduction gear. With a ratio of 1.63:1 this gives a prop speed of 200 rpm. A St. Louis Ship modified Kort nozzle shrouds each wheel.

The three 125 kw 480 volt Delco generators are driven by General Motors model 6-110 diesel engines and like the main engines are cooled by the Vapor Phase System and run at a constant temperature of 252° F. The Vapor Phase equipment for handling heavy fuel has proven very efficient in the Company's other four wheel boats *(Macleay, Missouri* and *United States)* over a period of years. The latent heat principal which is the heart of the Vapor Phase System makes it possible to accurately control the temperature of the ambient cooling water by means of preselecting the pressure in the system. The engines on the *America* generate approx. 9000 lbs. of steam per hr. at full load conditions and at 15 lbs. pressure. With the system a mixture of steam and water from the engines passes to a separator where steam is extracted and the water is returned to the engine at substantially the same temperature as the mixture leaving the engine. Temperature of liners, piston heads and skirts, water over heads and around lower cylinders is more nearly equal (according to thermo-couple tests), and so of course is the ratio of expansion. In a cylinder of this size this is said to make a lot of difference in liner wear, ring fouling and sludging of lube oil. The biggest advantage (costwise) is that residual fuel can be used, and at all speeds after initial warmup and with the high, even heat, the possibilities of condensation are eliminated.

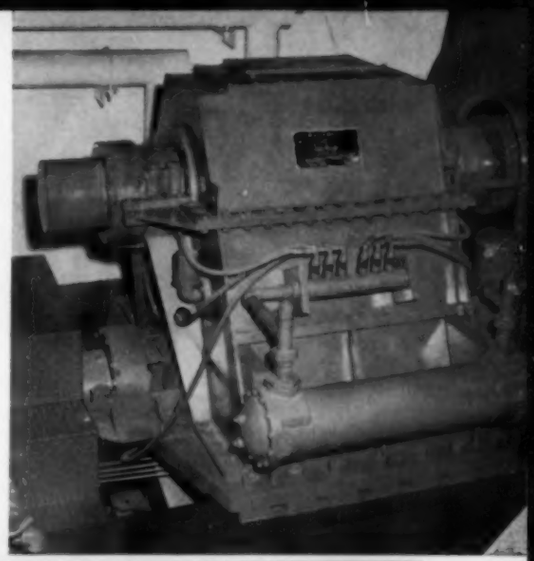
Cooling water for condensers, main and auxiliary engine lube oil coolers is circulated through a closed skin type cooling system which forms an integral part of the sides of the hull plating below the

With four Cooper-Bessemer 2250 hp diesel engines, the *M/V America* ranks as the most powerful river towboat. A near-twin to the *M/V United States,* also operated by Federal, the *America* can handle a tow equaling capacity of 1000 freight cars.

Pilot house, showing location of steering and flanking rudder controls as well as Westinghouse Air Brake single lever pneumatic engine controls.

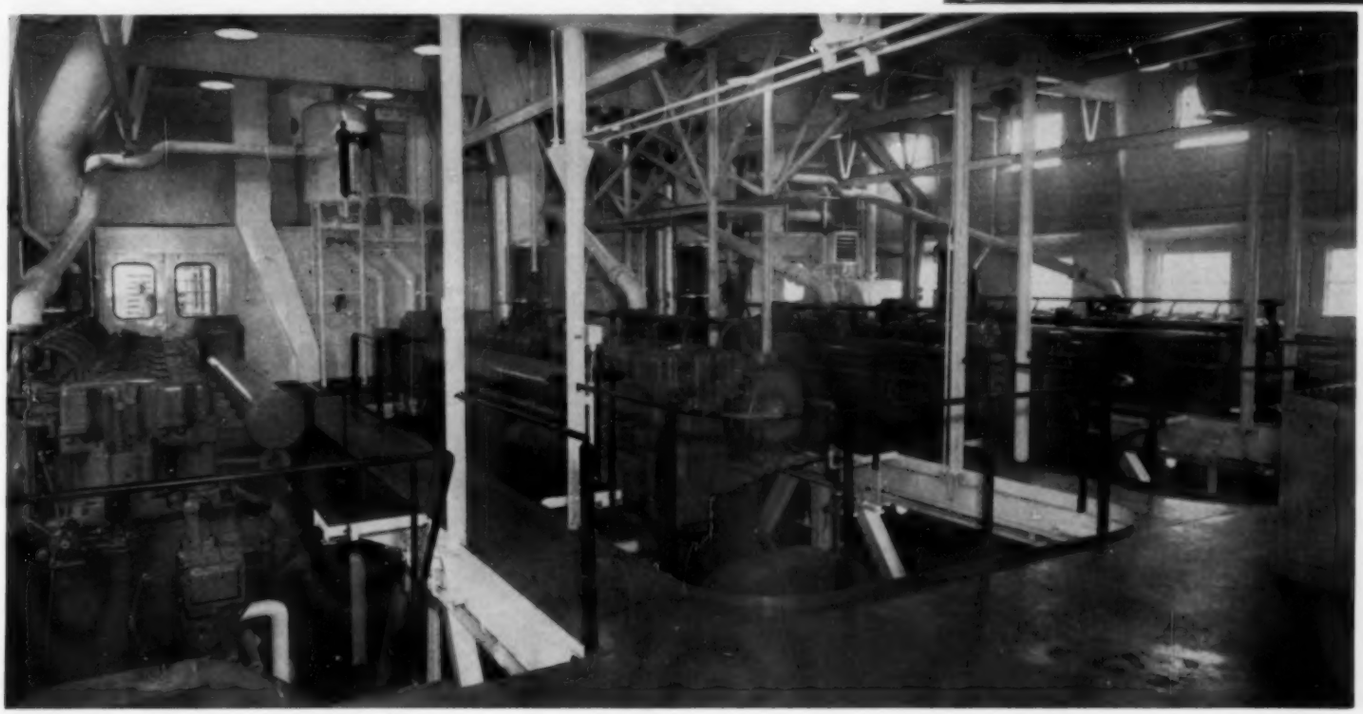
water line. In the propulsion engines Allis-Chalmers centrifugal pumps circulate the coolant while the generator engines use thermal circulation. Regular (light fuel) is used at all times in the generators and for initial warmup of the mains. Light fuel carried in four hull tanks cross connected, can be pumped to the main engines through a duplex filter at a constant pressure.

The heavy fuel is kept at 80 to 90° F in eight steam heated bunkers with steam supplied to the coils from the Vapor Phase separators. A DeLaval Imo pump transfers fuel to and from any bunker. It is then drawn through a preliminary stage heater, where its temperature is raised to 180° F, by two Westphalia continuous type centrifuges, which discharge to a 200 gal. steam heated heavy fuel day tank. From the day tank it is pumped by two service pumps and discharged through four final stage steam heaters and electric heaters which raise the temperature to about 285° F. After filtering in four Hilco duplex filters it arrives at the engines through the four Nemec fuel control panels. These latter automatically switch from heavy to light fuel with a purging period to cleanse the lines of heavy fuel. Complete control of fuel supply by the engineer is through Westinghouse Air Brake Controls between engine room central control station and the Nemec control of each engine. DeLaval Uni-matic lube oil centrifuges and a set of purifiers continuously clean lube oil from each of the four engines.



One of four Western Gear Sea-Master reduction gears which makes possible efficient wheel speed of 200 rpm. Ross lube oil cooler is in the foreground.

Part of the engine room from the main deck level. Installed are four Cooper Bessemer LS-8-DRT diesels with 15½ in. bore, 22 in. stroke and developing 2250 shp. Two Vapor Phase separators are at second deck level at left center.



The two powerful St. Louis Ship designed and built steering systems of the mechanical-hydraulic type give the pilot absolute control of the four steering and six flanking rudders, using separate levers for each set of rudders (steering and backing). Hard-over to hard-over takes about 14 seconds with full flow of water against rudders. By means of the follow-up system the position of these pilot house levers indicates the exact angle of the rudders. The hydraulic rams, the quadrants and other gear to move the big rudders are housed on the after end under a sloping deck that carries out the familiar profile of this class of boats.

The dead front switchboard is hooked up for parallel operation of the generators which it controls as well as the power takeoffs and lighting circuits.

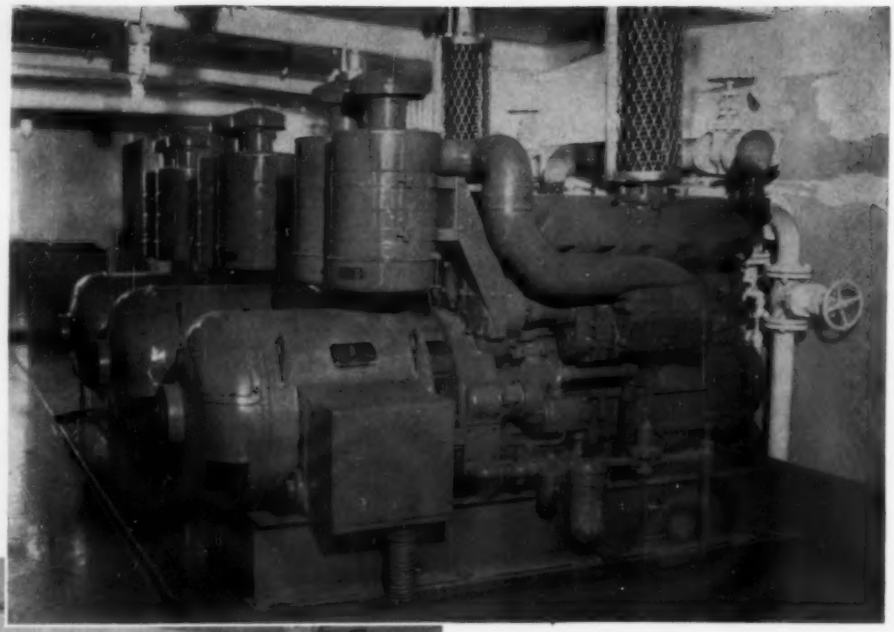
Dc power for the two searchlights is furnished by a 15 hp 10kw Fairbanks-Morse generator set. The full vision pilot house contains all the latest in navigation gear. Also on the console with the steering levers are the four throttle levers, one for each engine. With these the engineer can start and stop each engine and also control the cam rigging which reverses the engines. Controls are Westinghouse Air Brake. Identical controls are located on the control stand in the engine room where by means of a selector valve the engineer can control the engines if the need arises.

The familiar F. B. L. house colors (lemon yellow with black trim and grey decks) give the big three decker a distinctive appearance. Just below the pilot house is the beautifully appointed officers and guest lounge and the two guest bedrooms. The second deck houses the officers quarters and the main deck which has an ample deck locker and lounge forward houses the crew.

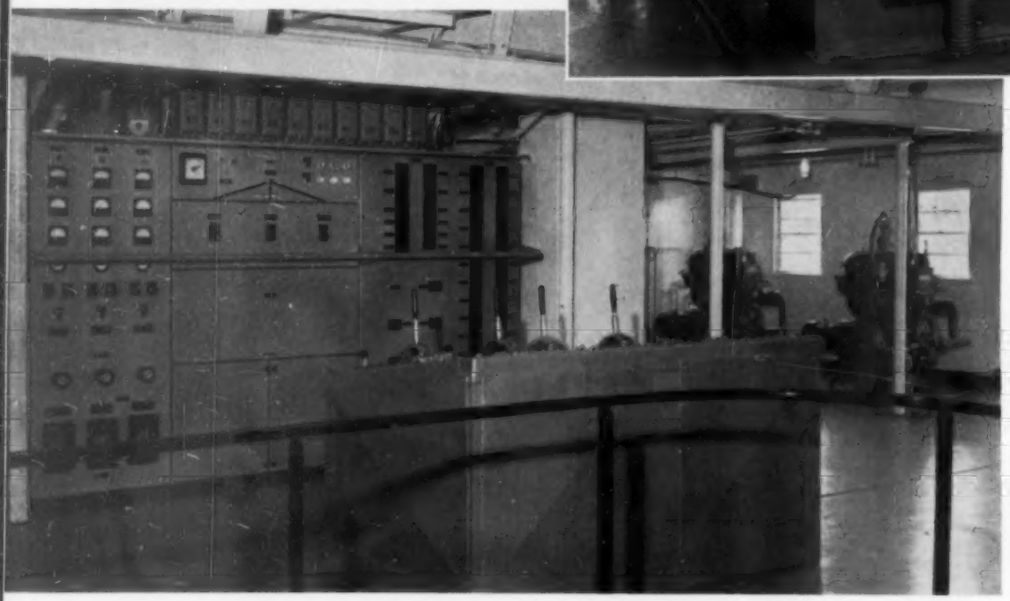
The massive three story engine room which also houses all the other machinery is well lighted,

ventilated and soundproofed. In its upper story are housed the Vapor Phase Separators as well as the Burgess-Manning exhaust silencers.

The massive size of the towknees on the headlog give graphic evidence of the brute force this vessel exerts on a tow. To transfer this power from the thrust bearings through the hull to the towknees, the hull is well braced by being generously subdivided and framed on the transverse and longitudinal system with the bottom, bilge and tunnel plating of ½ in. steel. Side plating and all bulkheads are ⅝ in. and stiffened both vertically and horizontally. Deck plating ranges from ¼ to $\frac{7}{16}$ in. thick.



This battery of GM 6-110 diesels drive Delco generators to power all electric gear on the *America*. Generators are rated 120/240/480 volts ac. Piping at front of engine is for Vapor Phase system which maintains engine coolant at constant 252° F temperature. Note Donaldson air cleaners.

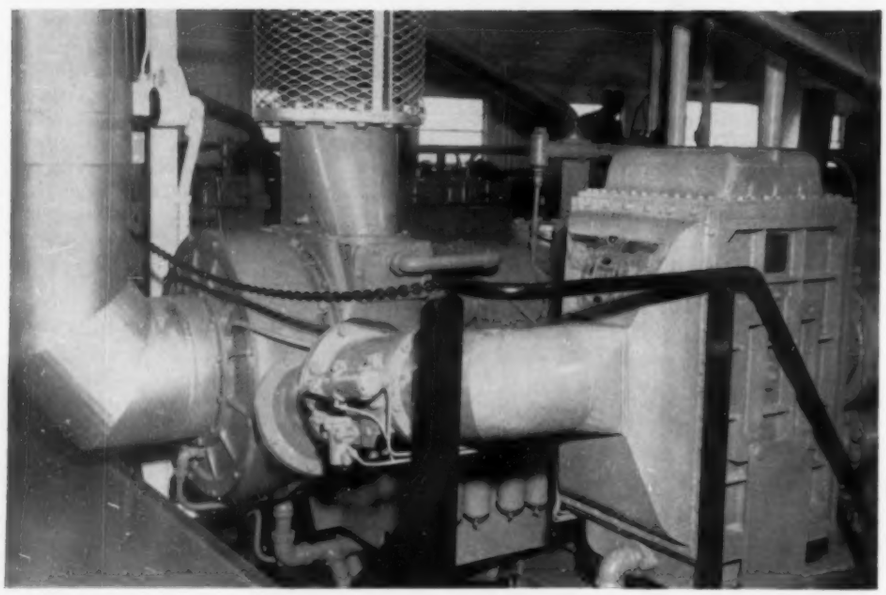


Switchboard is mounted directly behind engine room control stand. Control console has Westinghouse Air Brake single lever controls for engine. In background are Westphalia fuel oil separators.

Principal Equipment

Serving Four Cooper-Bessemer Main Engines

Reduction gears	Western Gear
Governors	Woodward
Recording tachometers	Minneapolis-Honeywell
Vapor Phase System	Engineering Controls
Temperature control valves	Amot
Fuel oil service pump	Gerotor
Intercoolers	Young
Intake air filters	American Air Filter
Exhaust silencers	Burgess-Manning
Fuel control units	Nemec
Engine controls	Westinghouse Air Brake
Raw water pump	Aurora
Air compressors	Gardner-Denver
Lube oil priming pump	Goulds
Heavy fuel centrifuges	Westphalia
Lube oil centrifuges	DeLaval Separator
Heat exchangers and condensers	Graham
Fuel oil filters	Hilliard
Motor generator set	Fairbanks-Morse
Turbocharger oil filters	CFC Fulflo
Reduction gear heat exchangers	Ross
Exhaust pyrometers	Alnor
Serving Three General Motors Auxiliary Engines	
Temperature control valves	Amot
Generators	Delco
Governors	Woodward
Fuel oil filters	CFC Fulflo
Air cleaners	Donaldson
Fuel oil pump	Viking



Turbochargers, and Young intercoolers are mounted on forward end of the main engines. CFC Fulflo lube filters serve the turbochargers.

ALUMINUM *JIGMIL IV* HAS 900 SHP

All-aluminum *Jigmil IV* is 72 ft. long, can accommodate party of six, crew of three. Vessel has latest navigating equipment, two aluminum lifeboats on aft deckhouse roof.

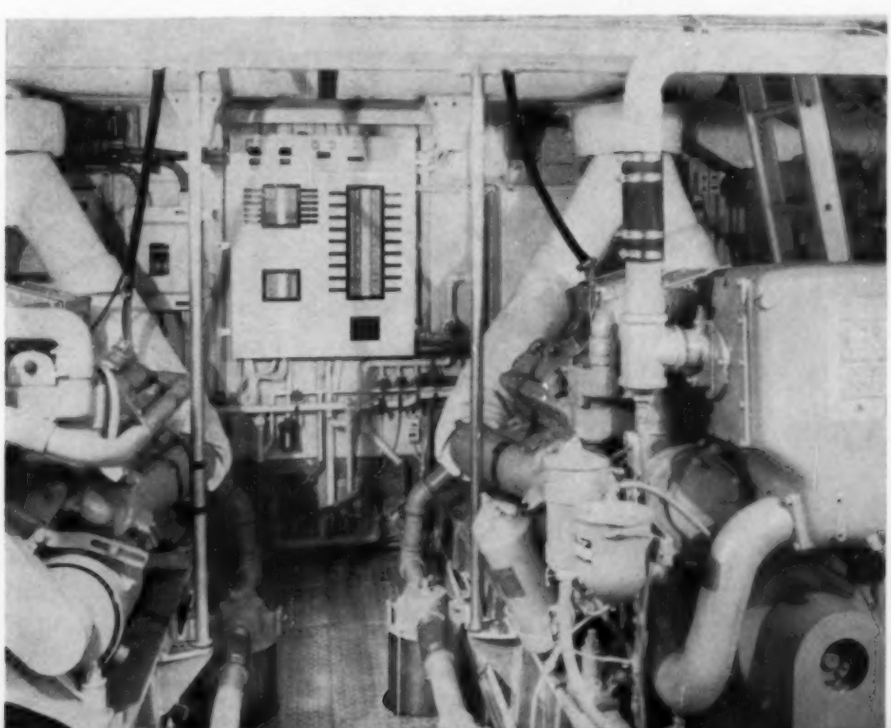
LIGHT weight and high speed are two of the outstanding characteristics of the *Jigmil IV*, one of the newest pleasure boats to join the fleet at the Grosse Pointe (Mich.) Yacht Club. The new 72 ft. yacht is distinctive in her class in several ways. Number one, she is all-aluminum and among the largest in the world with this construction; two, she is one of the first to be powered with General Motors 12V-71 marine diesels. For her owner, Industrialist Charles B. DeVlieg, of Royal Oak, Mich., this combination means exceptionally high speed, seaworthiness, comfort and ease of maintenance. The *Jigmil IV* was designed by Naval Architect J. B. Hargrave and built at the Burger Boat Co., Manitowoc, Wis. The sleek 72 ft. 2½ in. craft has a beam of 17 ft. 8 in. and 5 ft. draft. She was built to realize DeVlieg's ambition for a boat whose performance would set new standards for the boating world. The yacht can accommodate a party of six and carries a three-man crew. Cruising speed is 18 mph and a top speed of 22.8 mph was reached in her trial runs.

A pair of General Motors 12V-71 diesel engines provide propulsion power for the aluminum-hulled craft. The diesels were selected to complement the weight saving design of the vessel. Weighing only 4600 lbs. each, including marine gear, the 12 cylinder engines have bore and stroke of 4½x5 in. and each develops 456 shp at 2300 rpm. Each of the matched 12V-71s turns a 38x38 in. propeller through Twin Disc model MG-512 reverse-reduction gears. Her 2400 gal. fuel tanks give the yacht a cruising range of 1500 mi.

The compact design of the engines allowed use of an engine compartment of standup height and with ample room for easy servicing. Access to the crew quarters, engine and storage rooms is through the galley by means of a hydraulic disappearing ladder operated by electric switches. A dry stack carries exhaust up and away from the boat so there is little noise at the deck level. Engines were supplied by Inland GM Diesel, Milwaukee.

Auxiliary electric power is provided by a Kohler model 15 ROT63, four cylinder diesel engine driving a 115/230 volt ac generator.

Propulsion power for *Jigmil IV* is provided by this pair of matched GM 12V-71 diesel engines, each of which develops 456 shp at 2300 rpm. Engines drive through Twin Disc model MG-512 reverse reduction gear with 3:1 ratio.



The all-welded hull is of aluminum as are the keel, frames, deck beams and shell plating. All components were designed and engineered for maximum strength and minimum weight. Four watertight bulkheads provide five compartments. Fuel and water tanks are integral with the hull in the double bottom section to fully utilize otherwise unused space while locating variable weight well below the center of gravity for maximum stability.

In all, 35,000 lbs. of Reynolds aluminum were used in *Jigmil IV*. Of this, 26,000 lbs. were of ¼ in. and $\frac{5}{16}$ plating used on the deck and hull, plus the $\frac{5}{16}$ in. plating on cabin and interior decks. Extrusions totaled 8500 lbs. and 500 lbs. of aluminum sheet were used. All were specially formulated for marine use to give maximum stiffness and corrosion resistance while retaining high tensile strength.

Burger Boat Co., President Henry C. Burger estimated that all-aluminum construction effects a 20 per cent overall weight saving over a steel boat and 10 per cent over wood. Speed would be an estimated 15 per cent greater than for a wood boat, up to 25 per cent higher than that of a steel vessel, along with better maneuvering characteristics and increased bouyancy. Architect Hargrave estimated that total weight of the metal hull and deck structure work out to about 48 per cent of the steel equivalent. He put the ratio of speed to weight in a 40 ft. aluminum boat at about one mph gained for every 1500 lbs. saved. While this would not hold true for a boat the size of the *Jigmil IV*, the principle accounts for her outstanding speed.

THREE VERSATILE, LOW COST FIREBOATS FOR BALTIMORE

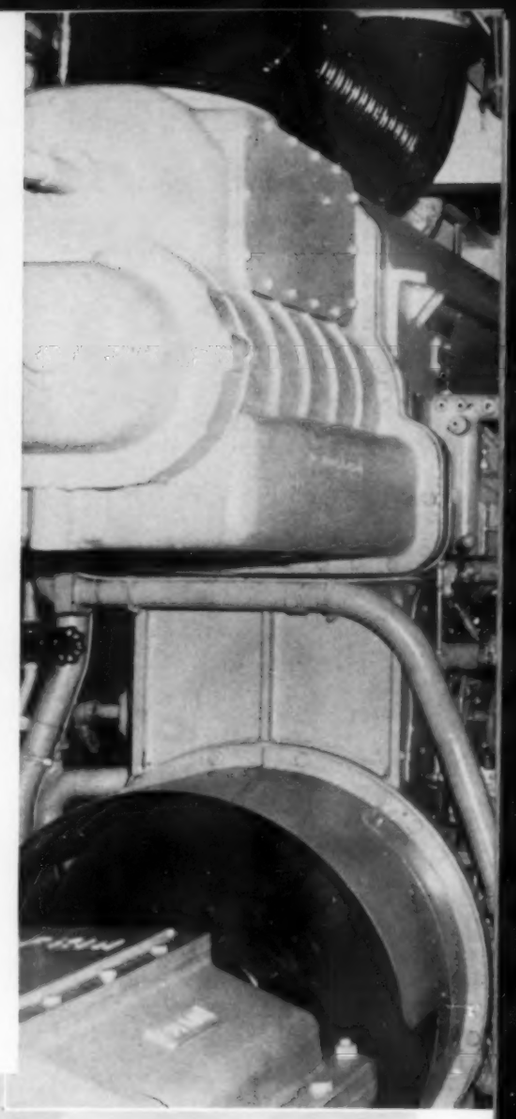
By ROBERT E. SCHULZ

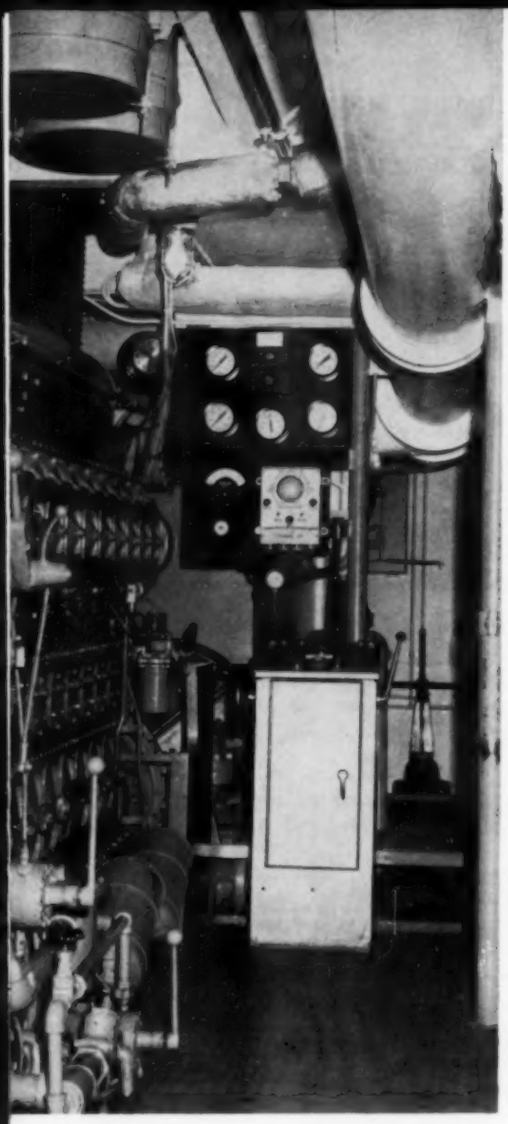
BALTIMORE, Md.—In designing and building boats, as in every other job, teamwork makes the difference. A classic example of this was demonstrated here at this eastern seaport city recently when three new, extremely versatile, yet low cost, controllable pitch, single screw fireboats were placed in service by the Baltimore City Fire Department. The boats, each a trim 85 ft. in length and rated 6000 gpm, were delivered at a total cost slightly in excess of $1 million. To attain 18,000 gpm capacity in three boats at this price dictates ingenuity on the part of the naval architect and close cooperation on the part of the builder and major equipment suppliers. Equally important, the Baltimore City Fire Department has estimated that the savings in fuel, maintenance and personnel achieved by operating diesel propelled vessels rather than steam will pay the initial costs of all three of the new fireboats in less than ten years time.

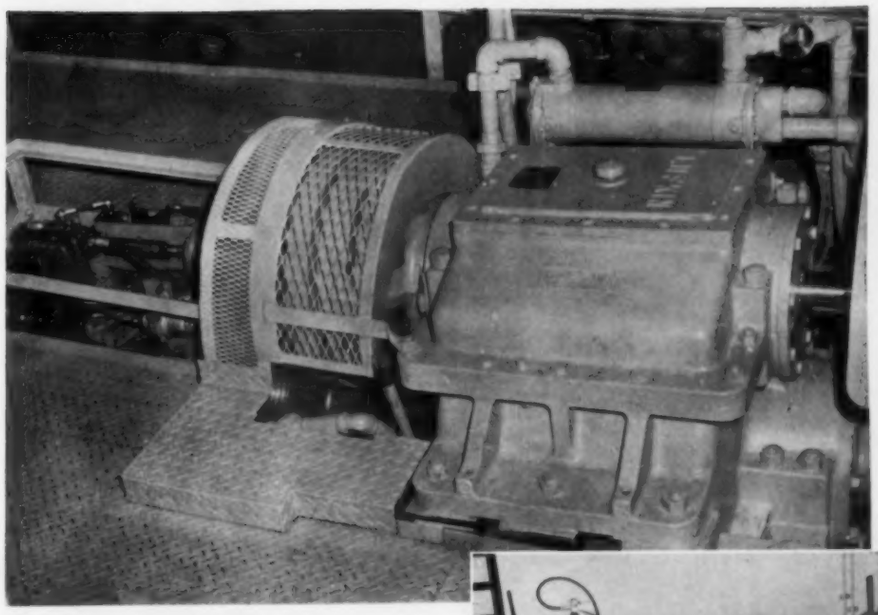
Here in Baltimore I met with John T. O'Mailey, executive secretary of the Board of Fire Commissioners, and later boarded the *P. W. Wilkinson,* which is identical in all respects to the other two new boats, the *Mayor J. Harold Grady* and *August Emrich.* These three boats, together with the four-engined, 2640 hp diesel fireboat *Mayor Thomas D'Alesandro, Jr.* built in 1956, give Baltimore a complete diesel fleet—two steam boats and a converted sub-chaser now being retired. The four boats are strategically located at points in the Baltimore Harbor to provide fast, efficient fire-fighting action. And with good reason when you consider that fully 70 per cent of Baltimore's total business generates from the Port.

Designed by Naval Architect Thomas D. Bowes of Philadelphia, the three boats were constructed by the Jakobson Shipyard, Inc. of Long Island, N. Y. Each has a length overall of 85 ft. 4½ in.,

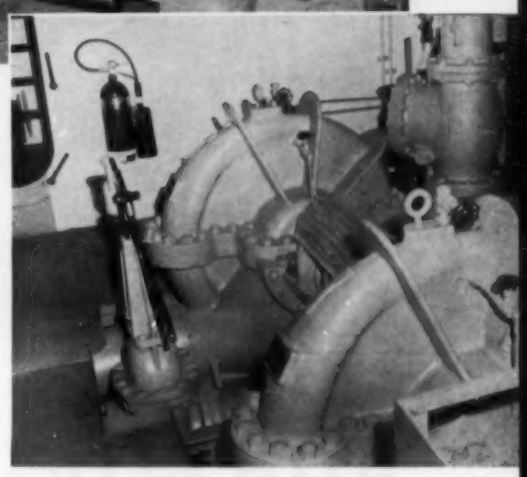
Pilot house showing pneumatic engine-propeller control stand produced by Westinghouse Air Brake in conjunction with Bird-Johnson. This single lever stand controls ahead or astern pitch and integrated engine rpm and has illuminated pitch indicator dial.







Propulsion on the three new boats is through a Lufkin 2.49:1 reduction gear, and Wichita air actuated main clutch. To left is KaMeWa oil distribution box with direct reading pitch indicator.



Propulsion drive end of 10 cylinder F-M diesel rated 880 hp at 1200 rpm. In background is KaMeWa engine room stand and gauge board with Alnor pyrometer. Air Maze air filters and Purolator fuel oil filters are shown.

The two Fairbanks-Morse 8 in. fire pumps are each rated 3000 gpm at 150 psi discharge pressure, 1200 rpm.

a beam of 13 ft. 9 in., and a draft of 7 ft. 4 in. with a displacement of 120 long tons. In his unique design, Architect Bowes has incorporated a KaMeWa controllable pitch propeller manufactured by Bird-Johnson Co. so that a single engine can be used for both pumping and propulsion. By eliminating duplicate engines, the engine room size was kept to a minimum, resulting in a very compact vessel of shallow draft and subsequent cost reduction. Providing the propulsion power on each vessel is a Fairbanks Morse model 38F5¼, ten cylinder, opposed piston diesel rated at 880 cont. hp at 1200 rpm. Each drives through a Lufkin 2.49:1 reduction gear and Wichita air-actuated clutch to the KaMeWa propeller. The two 8 in., 3000 gpm, 150 psi F-M fire pumps are driven off the front end of the engine through a Fawick air clutch.

When responding to an alarm, the engineer starts the engine and engages the Wichita clutch between the engine and the propeller shaft. All starts are made with the propeller blades in neutral pitch and the vessel does not move until the captain is ready to take over the controls on the bridge. The pitch of the blades is adjusted directly from the pilot station on the bridge by a single lever control which simultaneously selects both propeller pitch and speed with the ratio of pitch-to-speed programmed in advance to provide optimum maneuverability as well as maximum vessel speed without overloading the engine. There is also a mechanically connected slave stand on the opposite side of the bridge and an engine room control, the latter arranged for separate control of pitch and engine speed.

En route to the fire, all of the engine horsepower is available for propulsion and early service has shown speeds up to 15 mph. When the vessel reaches the fire, the clutch to the fire pumps is engaged, at which time about 80 per cent of the engine power is used for driving the two fire pumps. The remaining 20 per cent of power is available for maneuvering the vessel or holding station. The KaMeWa propeller also makes it possible to use full engine power with optimum pitch adjustment for towing burning vessels. The KaMeWa propellers are three-bladed, nickel-manganese-bronze with a 58 in. dia., a blade area ratio of .50, and a design pitch ratio of .45. Tailshaft is 6¾ in. dia. and is ABS Grade 2 forged steel with centrifugally cast bronze liners, and pre-vulcanized sheet rubber covering between liners.

Auxiliary power aboard each boat is furnished by a pair of GM 110 diesels driving 30 kw Delco generators. Air for the Ingersoll-Rand starting motors on these sets, as well as for starting the main Fairbanks-Morse propulsion-pumping diesel is supplied by Quincy compressors. Spark arrestor Maxim silencers are used, as are Air Maze filters.

The *Mayor J. Harold Grady, P. W. Wilkinson* and *August Emrich*, each powered by an 880 hp Fairbanks Morse OP diesel, display their pumping capacity in Baltimore Harbor.

List of Principal Equipment

Engines	Fairbanks-Morse
Reduction gear	Lufkin
Propulsion air clutch	Wichita
Propellers	KaMeWa (Bird-Johnson)
Governors	Woodward
Pneumatic controls	Westinghouse Air Brake
Silencers	Maxim
Air filters	Air Maze
Compressors	Quincy
Pyrometer	Alnor
Heat exchangers	Young
Fire pumps	Fairbanks-Morse
Pump clutch	Fawick
Lube oil and fuel oil transfer pumps	Viking
Auxiliary diesels	GM Detroit
Auxiliary generators	Delco

TWIN 340 HP UNITS POWER *PANTHER*

ONE of the newest small tugboats ready for service along the Gulf Coast is the M/V *Panther*, a 51 ft. workboat packing twin 340 hp Allis-Chalmers marine diesels. Built by F. B. Walker & Sons, Inc. at its Pascagoula, Miss. shipyards for sale by the Mechanical Equipment Co. in New Orleans, the *Panther* typifies a trend to greater installed horsepower for vessels of this type. According to the present owners, this boat with its 680 hp can handle slightly larger tows, but more important, can accomplish more work per day with the same size crew. The owners believe the *Panther* will be assigned to service on the bayous and canals in the coastal area of Louisiana, primarily pushing oil barges, drilling rigs, etc. Pull tests were not completed as this story is written, but the *Panther*, running free, recorded 12 mph.

The *Panther* is of all-welded steel construction with a length overall of 51 ft., a 16.4 ft. beam

***Panther*, 51 ft. workboat has two 340 hp Allis-Chalmers 21000 engines. Vessel is of welded steel construction.**

HALIBUTER UPS PROFITS WITH EXTRA HORSEPOWER

EXTRA speed and horsepower is great for pleasure boats, but it really pays off in the fishing industry. Take the 57 ft. North Pacific halibuter, *New Era* of Seattle, Wash., as an example. Owned by Skipper William Selset with his nephew, Reidar Selset, chief engineer, the vessel was repowered in 1960 with a 195 hp Waukesha model WAKDBM Resolute diesel engine. This engine replaced a 165 hp diesel and, according to Skipper Selset, the extra 30 horsepower enables him to get into port and sell his catch one day earlier. "Before you either made the market or you didn't," said Capt. Selset, "if you didn't, you just lost a day."

With her new speed and power, the *New Era* can land her catch in better shape. And with the time saved during the limited halibut season on the local and westward banks, it's possible this saving in time might mean the boat could make an extra trip.

The *New Era*, built in the Sagstad yards in Seattle in 1951, has an overall length of 57 ft., 16.5 ft. beam and 7 ft. 10 in. draft aft. Gross register tonnage is 47 tons, net is 32 tons. The Selsets use the vessel for tuna fishing and purse seining as well as

Captain William Selset, shown, and Chief Engineer Reidar Selset are co-owners of the *New Era*.

***New Era* on a trial run. Vessel was repowered in 1960 with Waukesha Resolute model WAKDBM diesel engine which replaced 165 hp engine to increase her speed by about one knot.**

Allis-Chalmers model 21000 diesel engines power the *Panther*, give her ability to handle larger tows faster. Engines are equipped with Schwitzer turbochargers, American Bosch fuel pumps, Penn safety controls, Capitol reduction gears. Unit at left is one of two Allis-Chalmers model 2BD-77 auxiliary engines which drive Electric Machinery 5 kw generators.

and a 5.8 ft. depth. The engines are the turbocharged Allis-Chalmers model 21000, each of which has a throttle rating of 340 hp at 2000 rpm, and a shaft hp of 230 at 1800 rpm. Of four-cycle, six cylinder design, the engine has a 5¼x6½ in. bore and stroke with a displacement of 844 cu. ins. The engines on the *Panther* are controlled pneumatically from the pilot house with a Westinghouse Air Brake system tied into the hydraulic governor on the American Bosch fuel injection pump. Each engine drives through a Capitol model HYC hydraulic reverse and 4.5:1 reduction gear turning 52 in. dia. x 36 in. pitch, four-blade Columbian bronze propellers. Also installed in the engine room of the *Panther* for auxiliary power are two Allis-Chalmers model 2BD-77 two cylinder diesel engines driving Electric Machinery 5 kw single bearing type generators.

The *Panther* is built for round-the-clock service and has crew accommodations for four. Fuel storage capacity is 4800 gals. The new tugboat precedes an 85 ft. twin screw tug now being built at the Walker shipyards for sea-going service. This vessel will be powered by four Allis-Chalmers 21000 diesels, arranged in twin sets to drive through the new Capitol tandem reverse and reduction gear.

halibut fishing. She has a hold capacity for about 60 tons of iced fish.

The Waukesha Resolute WAKDBM diesel reaches its rated 195 hp at 1600 rpm. The naturally aspirated, 6 cylinder engine has a bore and stroke of 6¼x6½ in. for 1197 cu. in. displacement. The engine drives through a Twin Disc model MG-512 reduction gear with 4.15:1 ratio and the marine gear is also equipped with a hydraulic trolling valve feature which allows infinite reduction during trolling by slipping the clutch plates. The propeller is a 50x48 in. wide blade Olympic wheel. The old propeller was 48x36 in. The new engine-propeller combination gives the *New Era* a top speed of 9.5 knots; average top speed 24 hour "day-in, day-out" service on long runs is 9.25 knots, a one knot improvement over the old diesel engine which the Waukesha replaced.

Skipper Selset said the new engine, despite its greater output, burns about the same amount of fuel as the 165 hp unit it replaced. The engine was installed by Piston Service, Inc., Seattle.

Waukesha model WAKDBM engine is rated 195 hp at 1600 rpm. The naturally aspirated engine drives the propeller through Twin Disc model MG-512 marine gear with hydraulic trolling valve. Gear has 4.15:1 ratio.

WATER TURBINES PROPEL NEW JET BOAT

By DOUGLAS SHEARING

JET propelled pleasure boats were first successfully introduced several years ago. Now, teamed with diesel marine engines, jet propulsion is receiving its first assignments in the work boat field. Polymer Engineering Co., Hitchcock, Tex., recently completed a 26 ft. workboat for Geophysical Service Inc., Dallas—which is using the craft for special marine seismic exploration for petroleum. The boat uses Hamilton marine jet turbines produced by the Turbocraft Division of Indiana Gear Works and driven by a pair of Caterpillar's new D330 diesel engines.

The jet principle depends on the law of motion which requires that "for every action there is an equal and opposite reaction." In a jet aircraft engine air leaving the tailpipe develops the thrust that moves the aircraft. In the water jet, water leaving the turbine produces the same reaction force to move the boat. The Turbocraft unit, invented by William Hamilton of New Zealand, differs from previous water jet units in that the stream is discharged behind the craft and into the air rather than underwater.

The 25 ft. (26.3 ft. with a protector-shelf above the aft jets), all-fiberglass workboat will be used in oil exploration work in shallow water where the much larger mother ship cannot operate. The *Seis-Jet* will carry a 2800 ft. long, 1500 lb. seismic cable plus another 1000 lb. of geophysical instruments in addition to other special and regular equipment and gear.

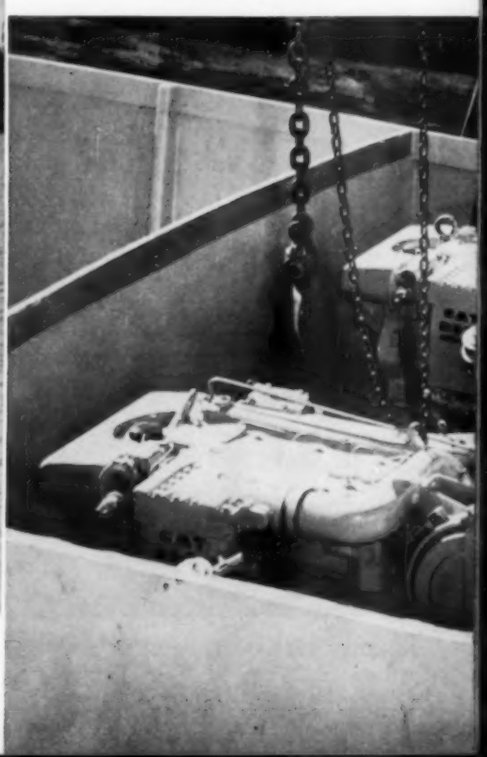
Jet propulsion was chosen for the craft because the jet principle, requiring no propellor or rudder below the hull, allows the boat to operate in very shallow depths (with its 18 in. mean draft, the *Seis-Jet* can run wide open in as little as two ft. of water) and also because the absence of rudder and propeller eliminates possibility of fouling the towed cable on those components.

The Hamilton marine jet turbine installed on the craft consists of three 7½ in. rotors and three stators, one aft of each rotor. Water is drawn up through a grated opening in the boat bottom, passes through the three stage turbine and is ejected at the transom and just above the waterline through a nozzle at the rear of the unit.

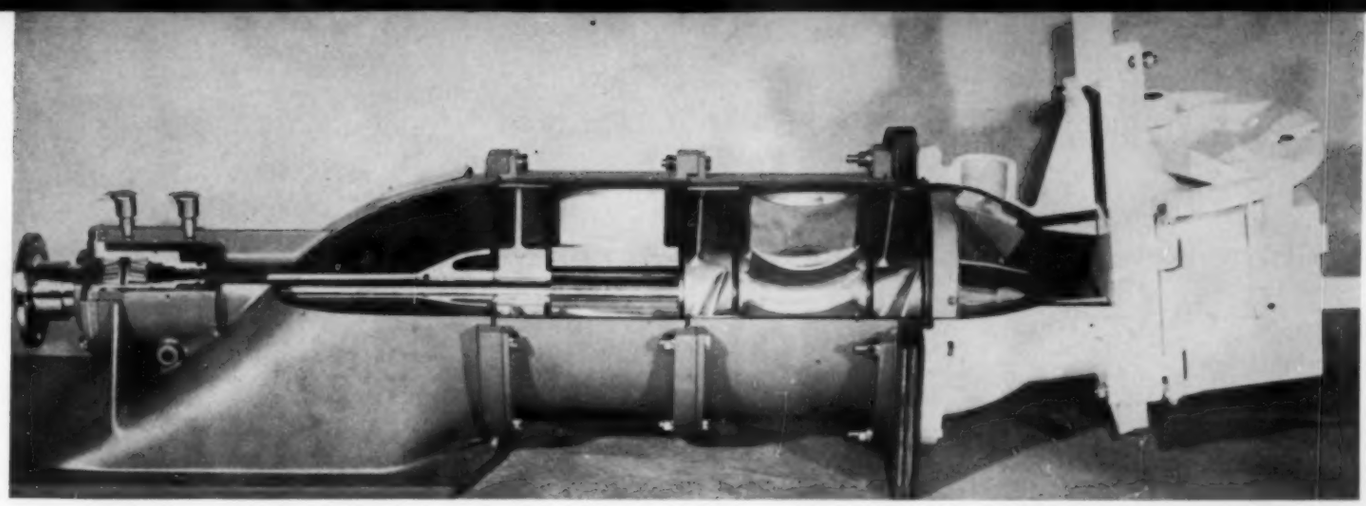
Thrust provided by the reaction force set up by the outrushing water can move the 15,000 lb. boat at speeds up to 10 mph. Forward, reverse and neutral are controlled by a gate, just ahead of the nozzle opening, which is wide open for forward, closed (to hold the water in the turbine) for neutral, and deflects the stream forward for reverse motion. Forward direction is controlled by changing the angle of two vertical deflection plates, one at each side of the stream and aft of the nozzle. Since the stream does not pass the deflection plate when the gate is in the reverse position the craft cannot be steered in reverse; direction is then controlled by shifting to forward motion to align the boat with the direction sought, then reversing the direction of the stream by means of the gate.

The D330 Caterpillar engines are turbocharged and aftercooled and are rated 110 cont. hp at 2000 rpm with jacket water to the aftercooler. They drive the turbines through Walter 1.7:1 speed increasers to obtain a 3400 rpm turbine speed. The D330 is one of the new Cat engines introduced in 1960. With bore and stroke of 4½ x 5½ in., the four cylinder engines have a displacement of 350 cu. in.

When engaged in geophysical work the required speed is only half of the 10 mph fully loaded top speed. Its ability to operate with efficiency at low



Workboat *Seis-Jet* has fiberglass hull, was built by Polymer Engineering Co. for Geophysical Service, Inc., Dallas. The boat is 25 ft. long, 26.3 ft. including shelf over jets to protect them when loading. Water turbines discharge stream at stern, just above the waterline.



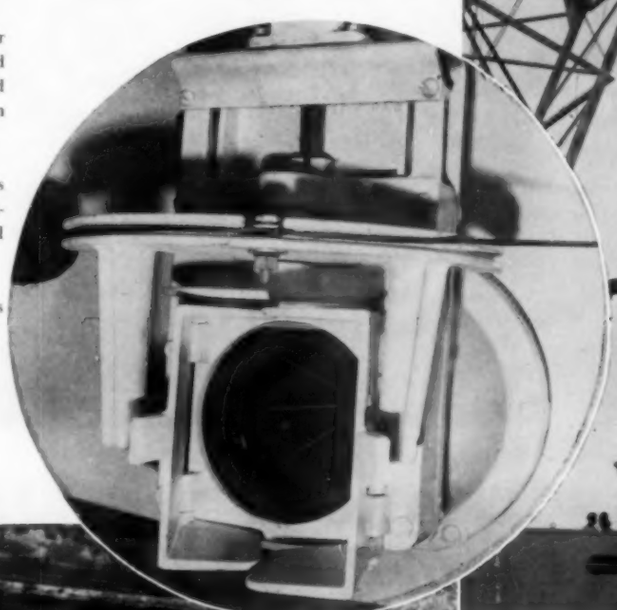
Cutaway model of Hamilton turbine shows the three rotors and stators. Water is drawn up through grated opening in hull bottom, then passes through turbine and is discharged through nozzle at the right. Operating speed of the turbine in *Seis-Jet* is 3400 rpm.

speeds, plus the lightweight design and compactness of the D330 led to its selection.

Greater efficiency is claimed for the engine-water turbine combination since, the water is confined within the tube in which the blades rotate, and this arrangement makes for less slippage between water and turbine blades.

Engineering and design work on the *Seis-Jet* was done by Blakely Smith of Houston. The Cat engines were supplied by Mustang Tractor and Equipment, also of Houston.

The hull of the vessel is completely of fiberglass



Steering apparatus for a water jet boat. Opening is nozzle end of turbine forward steering is controlled by movement of the two deflectors flanking outlet. Direction gate is between deflectors and nozzle and is in forward position, when in neutral nozzle is blocked, for reverse water stream is deflected forward.

The two Turbocraft 7½ in. water turbines on the *Seis-Jet* are each powered by a Caterpillar D330 diesel engine through Walter 1.7:1 speed increasers. Engines are turbocharged and aftercooled, develop 110 cont. hp at 2000 rpm. Blakely Smith, designer of the boat is shown, left, with engineer.

Seis-Jet is loaded aboard mother ship of Geophysical Service Inc. Small craft will be used for towing seismic cable in areas larger ship cannot reach.

and great strength was provided in its design. The result is a very rugged craft and in the event of damage to the hull, especially when the boat is working in out of the way parts of the world, repairs can be made easily.

"Although the diesel installations are on workboats, there is no reason why pleasure craft could not use diesel-jet combinations," said a Turbocraft representative. "The ease with which Polymer engineers made the installation speaks well for the jet turbine design. Essentially all one has to do is bore two big holes in the right places, one for the intake and one for discharge. Other than that, placement of the engine at the correct position is the only critical installation point."

TURBOCHARGED DIESELS GIVE RANGE AND SPEED TO NEW YACHT

By DOUGLAS SHEARING

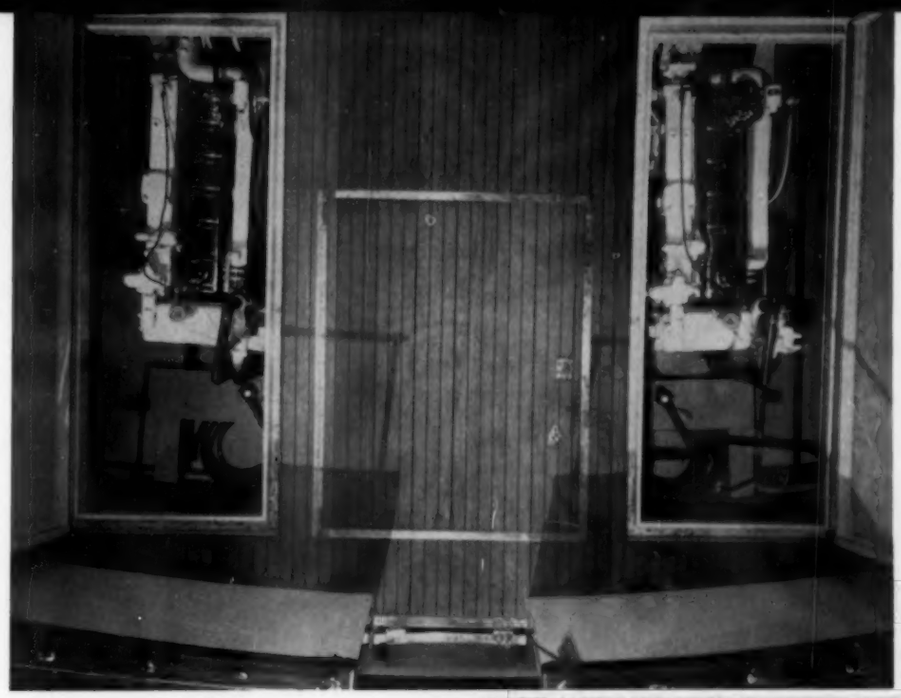
THE *NonaKay*, of Los Angeles, a roomy new, 40 ft. diesel-propelled salon sportsman, owned by the C-F Equipment Co. of Los Angeles, has stirred up Southern California yachtsmen more than is customary when even larger vessels of new design make the rounds of Avalon, Balboa, Long Beach and San Diego anchorages.

Propulsion is provided by twin 6 cylinder model C-200 Cummins turbocharged diesels. They provide sustained cruising speed of 16 knots and a range of more than 500 miles from the 500 gal. fuel tank. In her 40 ft. hull is a spacious deck-side lounge, two large double staterooms, full electric galley, lots of elbow room between engines in the machinery compartment, and commodious wardrobes and stowage space.

Mechanical and electrical equipment of the *NonaKay* represents the latest developments of Cummins, Onan and Jeffries. The twin Cummins six-cylinder, turbocharged diesel engines are rated at 130 hp at the cruising speed of 2250 rpm. At this engine speed, the yacht cruises slightly over 16 knots, with a fuel consumption of only 14 gals./hr. Capitol 2:1 reduction gears provide an efficient speed for the Equipoise propellers. Monel shafting is supported in especially designed struts with rubber bearings to reduce friction and drag.

Auxiliary power is a 6 kw Onan air-cooled diesel generating plant that provides alternating current for the galley range as well as direct current to charge the main bank of storage batteries for refrigeration, lights, engine starting, and the communications/navigation equipment. Cooling air for the Onan is ducted overboard. Oversize mufflers and vibration dampeners between all three engines and the hull reduce noise to a minimum. An unusual, but extremely practical, fuel system control panel is located directly below the Onan auxiliary, which diagrams the tanks, fuel lines, filters and circuits—with the valves protruding outward from the diagram. Above the auxiliary are the main junction boards for the electrical circuits, from which aircraft-standard type harnessed wiring runs to various parts of the yacht.

By the use of two Vee drives, all machinery is located aft, yet efficient shaft angles are possible. Morse flexible couplings between the reverse gears and the Vee drives eliminate mis-alignment prob-



Three hatches in sundeck permit easy access to the two model C-200 Cummins Turbodiesels that power the *NonaKay*. The flying bridge on the 40 ft. sportsman has all engine controls and communications equipment.

lems and permit the use of resiliant vibration dampeners under the main engines. This type engine installation also tends to place the engines in positions where they are easily accessible for service and inspection, well above the hull bottom. Overhead, sides and forward bulkhead of the entire engine room are soundproofed with fiberglass mat and Ensolite.

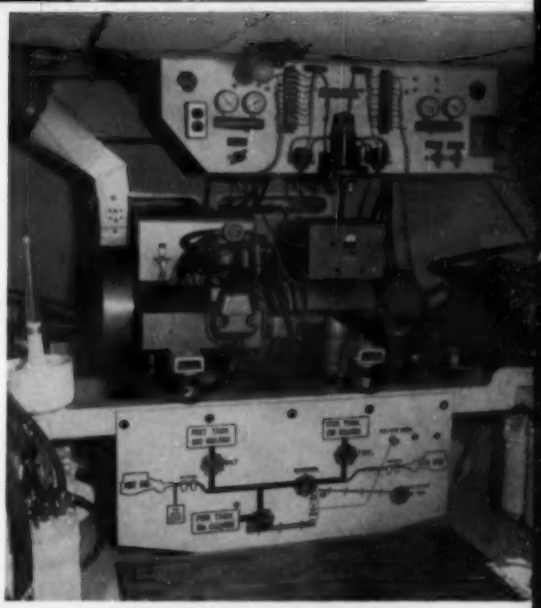
Normally the *NonaKay* is operated from the flying bridge, which is large enough for as many as eight to be seated comfortably. Steering controls are on the starboard side, with a well-equipped instrument panel for engine gauges to the left of it. An automatic pilot control box is adjacent to the wheel; protected within the locker under the instrument panel is the radiotelephone and 75 fathom depth recorder; a portable three-band direction finder completes the electronic equipment. A deck-side lounge control station is also provided for rough-weather operation. A duplicate set of Stewart-Warner instruments to those on the flying bridge are at this location, as well as the second set of engine controls, the automatic pilot controls and main switches.

Principal factor that makes possible this combination of spaciousness, completeness of equipment and extended cruising range is the basic hull design and construction method pioneered by Jeffries Boats, Inc., of Venice, California, builders of the *NonaKay*. The total displacement of the vessel is 12½ tons. Her beam is 15 feet 11 inches, and her draft 35 inches. With the exception of certain natural-finished teak trim, and the teak decks, the keel, hull, decks and superstructure are laminated materials. Three water-tight bulkheads provide the transverse rigidity to the hull that would otherwise require sawed or steam bent frames. Aside from the engine stringers, approximately 14 ft. in length and running from the transom to the bulkhead which separates the engine room from the tank room, there are no other longitudinal stringers used in the Jeffries design. The result of this type construction is a hull of extreme strength, but of considerably lighter weight, as well as a greater amount of space within the hull by elimination of frames and other timbers that would otherwise be required.

List Of Principal Equipment

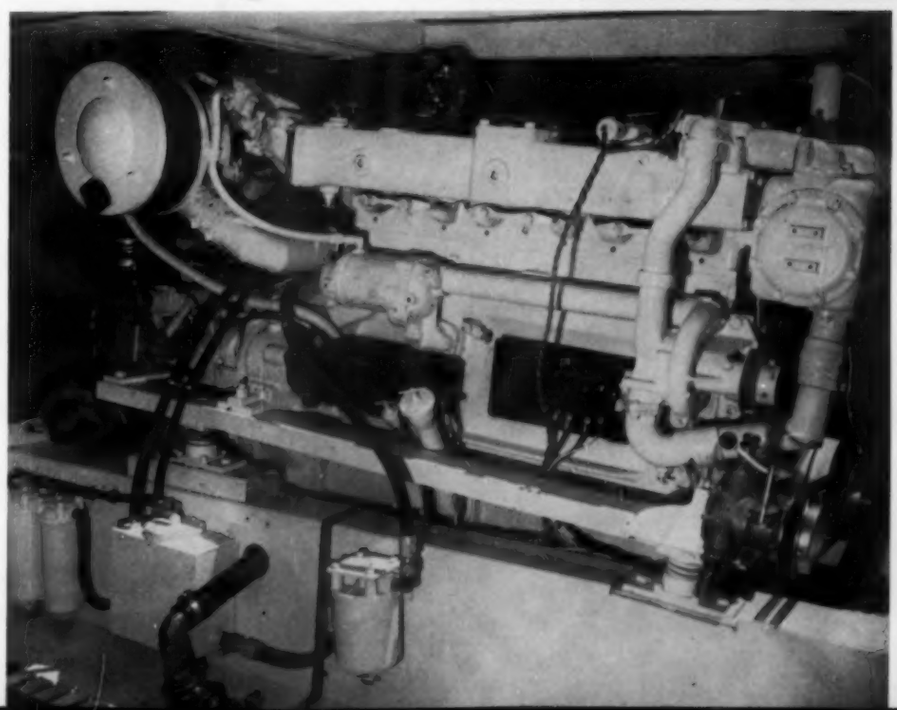
Engines	Cummins
Reverse-reduction gears	Capitol
Propellers	Federal
Auxiliary diesel	Onan
Flexible couplings	Morse
Mufflers	Elasto
By-pass lube oil filters	Luberfiner
Air intake silencers	Air-Maze
Fuel & lube oil lines	Aeroquip
Fuel filters and water separators	Fram
Seawater pumps and emergency pumps	Jabsco
Engine and auxiliary vibration isolators	Robinson
Exhaust pyrometers	Hewitt
Storage batteries	Willard

Birdseye view of sundeck, with two of three hatches open, shows position of Cummins 130 hp propulsion engines. Note center section of transom lowered to provide steps from swimming deck.



The Onan diesel 6 kw generator sets athwartship along forward bulkhead of the engine compartment. Below it is a fuel-flow diagram. The Vee drive forward of the starboard engine is shown at extreme right of this picture.

Manifold (inboard) side of starboard Cummins turbocharged engine looking forward where one of the Luberfiner filters, one of the Morse flexible couplings, and Aeroquip hose can be seen. Three Fram filters are visible, mounted on engine stringer. Note two of the Robinson vibration dampeners and Air-Maze air filter.



ANOTHER LOOK AT SMALL DIESELS FOR SMALLER TRUCKS

Here Is a Report By J. C. Campbell of Detroit Diesel Engine Division As Presented at Annual Meeting of National Truck Leasing System on Advantages of Diesels for Lighter-Duty Trucks; Higher Initial Cost is Simply Case of Investing Money to Make Money

USE of diesel engines in line-haul, heavy duty trucks is today widely accepted as both practical and economical. Attention is now turning to the use of smaller, high-speed and light-weight diesels for peddle runs, certain city delivery operations and light-load highway hauling. My remarks concern the significance of this, with particular emphasis on an answer to the natural question of the majority here; "What will this mean to me, a lessor of vehicles of this type?"

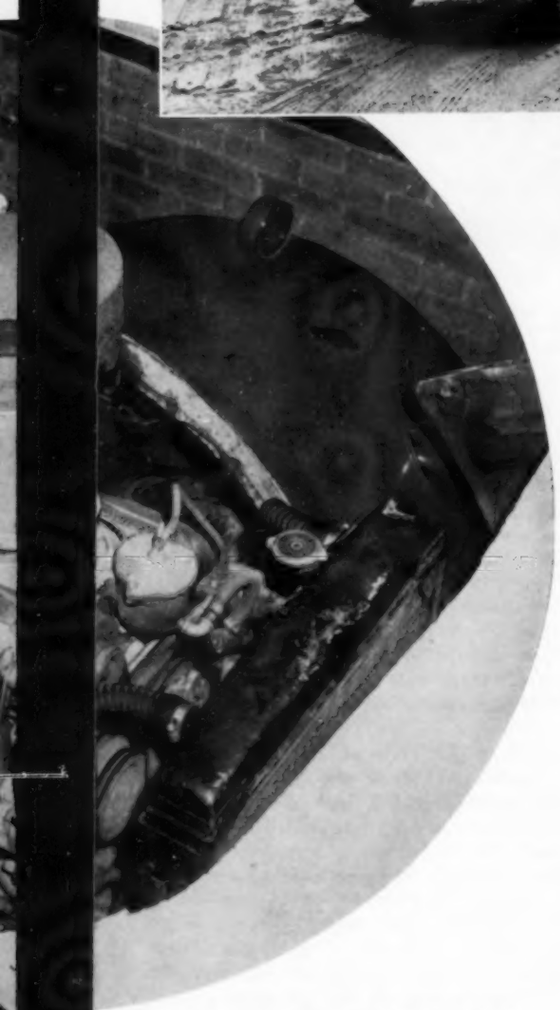
Small diesels have been successfully operating in European trucks for many years. The percentage of diesels in trucks rated from 12,000 gvw to 18,000 gvw in various countries is as follows: France 50%, Sweden 81%, England 95% and Germany almost 100%. The diesel got its amazing start in Europe at a time when there was an appreciable difference in the price of gasoline and diesel fuel. But, times change, and what is not commonly known is that *now*, both the availability and cost of the two fuels is becoming close to equal. Nevertheless, diesels are still gaining ground over there, and for the same reason that they are gaining domestically in heavy trucks. The economics favor diesel.

The facts are that small diesels offer advantages over gasoline engines, which include: (1) significant fuel savings and (2) performance and operating benefits both of which fully justify an investment in diesel. These factors in small diesel economics afford promising opportunities for added customer service and profit to the truck lessor who is cognizant of them. This, of course, implies an alert selection of prospects for small diesel truck leasing, and an ability to work out financial arrangements which can turn small diesel advantages into profit for both the lessor and the operator of the vehicle.

In comparison with gasoline engines, diesels require additional initial investment. But, this is simply a case of investing money to make money. When properly put to work, diesels' performance, superiority and operating economy can overcome that extra first investment with surprising ease and regularity. Since "full service" truck leasing provides "everything but the driver," many factors besides the original capital outlay must be taken into consideration. Basically, these factors are: (1) first cost differential (2) fuel savings (3)

Detroit Diesel 4-53 is in Ford F800 owned by St. Louis County (Minn.,) Road District #7. Truck averages 8.1 mpg in hauls of varied length, weight, hauls more gravel because of faster loaded speed, greater power on grades.

Underhood view of the Ford F800 showing 4-53 installation.



Installations view of Detroit Diesel 6V-53 engine, in Reo Gold Comet 220 owned by Universal Leaseways Systems, Inc., Southern California.

Universal's Reo Gold Comet 220, rated 72,000 lbs. gcw, was repowered with 6V-53 in June, 1960, has since averaged 5.9 mpg of fuel and "saved us hundreds of dollars in maintenance and downtime costs," according to Virgal C. Mart, service manager.

lower maintenance costs (4) reliability and availability of equipment.

First Cost Differential—Because diesels are more ruggedly built to withstand higher compression ratios, and to closer tolerances, their life expectancy is far greater than gasoline engines. As a result, they cost more. However, every diesel engine, now in operation, is making a living for someone by increasing production at no additional operating cost, or by maintaining the same production at a substantial reduction in cost of operation. Usually it is a combination of the two. Using selective application of diesels in smaller trucks, there is no doubt that the first cost can be justified *and paid for if you please,* in 2, 2½ or 3 years, depending on the loads hauled, miles traveled, and/or hours in operation.

Fuel Savings—In smaller trucks, averages tell us that when the vehicles are diesel-equipped they averaged substantially more than the same trucks with gasoline-engine power. Even when used exclusively within a city where high mileages are not encountered, the engines do idle a high number of hours and gasoline usage is accordingly high. Garbage trucks, for instance, with hydraulic rams run very few miles per day. Yet it is not uncommon to save ⅔ of the gallons used by substituting diesel for gasoline. A comparable diesel will idle four times longer on an equal amount of fuel as will a typical gasoline engine. Also to be considered is gasoline pilferage whether by the lessor or operator. Diesels eliminate this.

Lower Maintenance Cost—It has been well established by applications in trucks of all sizes that dieselization is one sure way to reduce downtime, with its assortment of maintenance expenses. Our experience indicates that diesel maintenance costs are somewhere between 30% and 40% less than comparable gasoline engines in lighter duty service. The principle reason is that the diesel completely eliminates spark-ignition and carburetion systems which are the most frequent causes of gasoline engine repair. In our Series 53 and 71 truck diesels, these are replaced by the compression ignition principle, and the simple, dependable unit injector fuel system.

Reliability and Availability—Closely akin to maintenance economy is the diesel's advantage in endurance and dependability. Because diesels are built with greater precision and ruggedness, their durability can stretch truck engine life between overhauls to three times that of comparable gasoline engines. This factor takes on added importance in the operation of smaller vehicles in limited numbers and with tight local schedules. Both lessor and operator benefit when a truck stays on the road, paying its way. Also important here is total engine life. With proper application and routine maintenance, a diesel maintains its peak operating efficiency.

The chances for a lessor to make useful and profitable applications of diesels in *smaller trucks* are excellent, particularly if the efforts are tempered with some good common sense. The immediate prospects are, as previously mentioned, those where savings on operating expense can overcome the diesel's added initial cost early in the life of the vehicle. Three conditions generally favor small diesels over gasoline engines:

(1) sufficient stop-and-go or part throttle operation to build up the diesel's fuel savings,

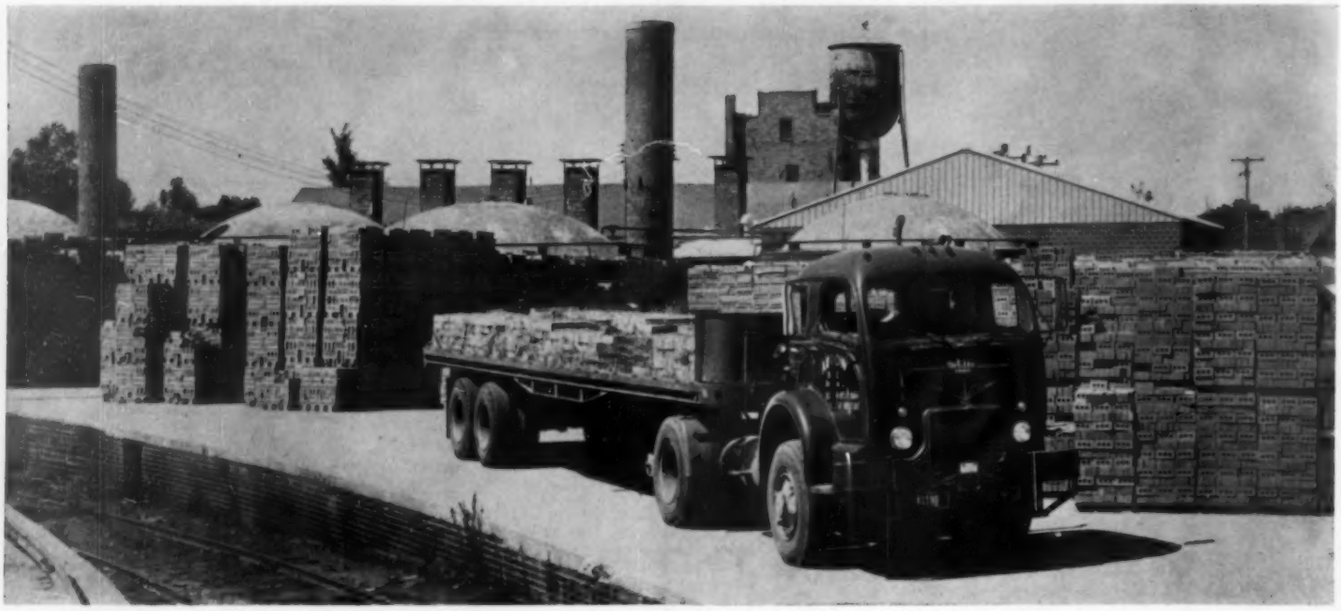
(2) high annual mileage, to take advantage of the diesel's lower maintenance costs,

(3) extended vehicle life, to make the most of the diesel's exceptional durability.

Wherever any of these factors are present, or any combination of them, the diesel can take over. Some characteristic examples are:

A bulk bread delivery truck or tractor and trailer, where high cube, but comparatively light loads are encountered in delivery to outlying areas or towns. A furniture manufacturer's tractor and trailer where conditions are similar.

City delivery trucks operating in traffic with considerable idling and/or part throttle driving



This White model 3000 COE, with Detroit Diesel 4-53 engine averages 8000 mi. a month for Arrow Transportation Co., Des Moines, Iowa, decreased operating costs 40-45 per cent, according to firm's officials. Truck hauls bricks and steel for the firm.

—where performance and reliability are important—where trucks are well kept, with long life.

Any inter-city hauling trucks where high annual mileage is encountered.

As are most businessmen, you are undoubtedly concerned with the narrowing margin between costs and prices, or rates. Since the small-truck diesel is an investment that pays, a logical question is: "How does the lessor sell this added investment to his own benefit, as well as to the operator?" While prudence requires that I leave the financial "engineering" of your business to you, I trust you will allow me to offer some observations resulting from my own interest in your business.

The initial extra capital outlay for the diesel, and its depreciation, might at first seem to be an item to be immediately added to a weekly or monthly rate . . . much like other truck components which increase the original purchase price of the truck, such as power take-off, air brakes, two-speed axle, power steering and so forth. It should be possible to sell the diesel as simply an "accessory." It should be considered an investment destined to return its value and more. If a basic rate increase is dictated by the diesel's amortization over a 5 year depreciation schedule, the realization of fuel and maintenance savings can benefit you or the operator through a lower per-mile rate. One fact should certainly be remembered here: the diesel truck will have a higher resale than a gasoline truck at the end of a 5-year period. At 40,000 miles per year, a five-year-old diesel should be just approaching its "second wind" . . .

In the area of maintenance cost reduction, the small truck diesel "touches the heart" of full-service leasing, with an appeal to all in reduced maintenance. It beats the squeeze on profits with an honest 30% to 40% decrease in maintenance over comparable gasoline engines. This can best be understood by imagining a complete release from ignition and carburetion problems, from coils, points and condensor troubles. A good example of the dependability of diesels can be pointed out in a company who operated about 200 diesel equipped dump and transit mix trucks. To care for this fleet they employ seven mechanics and helpers. They state that if these were gasoline powered, they would need 35 mechanics and helpers plus a sizable increase in service trucks.

Some case history stories of successful truck lease applications may indicate to you the opportunities these Series 53 engines afford. A lessor in Oakville, Connecticut, has recently repowered an International S-180 tractor with a 3-cylinder Series 53 diesel, replacing a 135 hp gasoline engine. It pulls a semi-trailer with 8-10,000 lb. payloads about 1000 miles/week between New England cities within a 300 mile radius. Fuel mileage jumped to 11.5 mpg of diesel fuel. With the 4-cylinder Series 53 diesel, another lessor solved the problem of a client in Anniston, Alabama operating a Dodge D-600 van-bodied truck. The truck suffered from a shortage of power to negotiate hills along its shuttle-route, with a 20-25000 lb. gross load. This caused frequent downtime for repairs to the gasoline engine. The 4-53 diesel was selected because it was easy to install, provided enough muscle to take the hills, and gave freedom from the constant fear of downtime enroute. A happy "plus" in the bargain was the diesel's fuel economy of 12 mpg.

White model 3000 tractor has 6V-53 diesel engine, is operated by McDonald Moving and Storage Co., Billings, Mont. Repowering helped reduce trip time 15 per cent, requires 50 per cent less shifting on grades, according to General Manager Elmer Hyde. Engine averages 9.7 mpg.

DESIGN AND APPLICATION OF PISTON RINGS FOR LARGE ENGINES

In December We Presented Part One of This Paper Which Was Delivered at the ASME Oil & Gas Power Meeting. Part Two Discusses Design Criteria for Compression and Oil Control Rings and Typical Piston and Ring Arrangements

By FRED A. ROBBINS and JOHN W. LIPPERT*

THOUGH the basic parameters utilized in piston ring design have been well identified for many years, the manner in which they are applied is changing significantly. These changes are best defined in terms of the trends ring and engine designers are applying. Compression rings vary in both configuration, Fig. 7, and material, and any change in either variable generally requires a review of the basic parameters.

Piston-ring tension is controlled by a complex relationship of the width, wall, diameter, free gap, and the material of the piston ring. The relationship between the ring wall and the tension should be balanced properly to permit installation over a piston without distorting the ring and destroying its contact pattern.

The tension of a compression ring should be sufficient to permit the ring to perform its sealing function. At the same time, the tension should not be of such a degree as to cause excessive drag and resultant loss in horsepower and increased wear. High-speed, high-output engines generally require higher tension rings.

When the optimum tension has not been established by test, the designer has one of two alternatives. He may borrow from past experience in similar applications, or he may apply the tension which will result when using the ideal free gap within the stress limitations of the material from which the rings are to be manufactured. The tension supplied by a cast-iron ring is usually sufficient to permit the ring to function satisfactorily. Generally, when a ring of a material of a higher modulus of elasticity, such as ductile iron or steel, is to be used to replace a cast-iron ring, the gap must be lowered or ring wall reduced to lower ring tension. Of all the piston-ring features, shape requires the most careful attention during manufacture. The mathematics required to predetermine shape are complex; but even more complex are the machinery and fixtures required to accomplish this shape. It may be surmised therefore, that shape is the most important design feature of a piston ring.

Since the shape of a piston ring in its free position is different from the shape of the same ring in its installed position, the piston-ring manufacturer must accurately predetermine the final shape which will result after this change from the free to the installed position. Many advances in piston-ring processing over the years have reduced the control of this feature from an art to a science; and piston rings are being manufactured today which produce the best installed shapes in piston-ring history.—*Note!* The precision of manufacturer is lost when improper installation practices are employed by the user.

Shape and pressure pattern are interrelated; and through improved techniques, the piston-ring manufacturers are attempting to produce rings with pressure patterns which are nearly uniform throughout the full 360 deg. of their circumference. The earlier practices of high tip pressure for 4-cycle engines are gradually disappearing in favor of the more uniform pressure-pattern ring. Tip pressure for 2-cycle engines is held nominally at zero to prevent port clipping. Flatness, too, is an important part of ring shape; and is necessary for the ring to perform its side-sealing function. Equal to ring flatness are piston-groove flatness and squareness, particularly in re-use of worn pistons.

For years, it was the opinion of many piston manufacturers and engine builders that back clearance was critical in only one respect—too little back clearance was sure to spell trouble. One hardly needed a crystal ball to foretell the future of any piston-and-ring combination when the groove was so shallow as to force the ring to carry the weight of the piston. However, the effects of too much back clearance were considered negligible. In recent years, both the engine manufacturers and the piston-ring manufacturers have, through tests and observations, concluded that piston-ring performance is improved by reducing the back clearance to a minimum. This reduced volume behind the ring permits an almost instantaneous response to combustion pressure, thereby reducing blow-by tendencies. By the same token, this pressure is released as quickly as the combustion pressure drops with the downward stroke of the piston—reducing wear.

The wall or radial thickness of a piston ring is the major factor controlling tension. A slight change in ring wall will have a greater effect on ring tension than a similar change in any of the other factors controlling tension. The wall also holds this same distinction when related to stress.

It is true that an increase in the wall of a piston ring will reduce the side wear of the ring under the same operatng conditions. However, this increase in wall will also reduce the conformability of the ring, increase the probability of distortion during assembly; and, unless other compensations are made, increase the unit pressure and face wear. Still, on the other hand, this wall increase will also afford, through higher beam strength, a reduction in the tendency toward port clipping in 2-cycle engines; and by reducing back clearance, improve ring response to combustion pressures.

These previous statements could be interpreted to mean that the designer plans to use heavier ring walls in the future. To date, we see no evidence that this is true. The heavier walls of which we speak are related to existing pistons and have been increased to reduce the back clearance between the ring and the bottom of the piston groove. We feel that the standard SAE and ASME piston ring walls are satisfactory, and plan to pro-

*Respectively Manager, Sales and Engineering and Project Engineer, Piston Ring Department, Metal Products Division, Koppers Co.

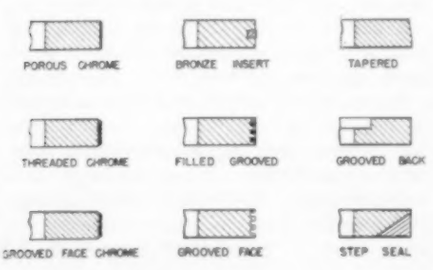


Fig. 7 Typical Compression Ring Types.

Fig. 8 Typical Oil Ring Types.

pose shallower groove depths on future engines as a means of reducing the back clearance; and at the same time, maintain the mechanical advantages that standard piston-ring walls afford.

When gas engines were in their infancy, they were for the most part converted diesel engines. This, then, caused them to fall in the same category as diesel engines in the minds of the component manufacturers. For the most part, little change was made in the design criteria of the piston-ring manufacturer. The recommendations concerning side clearance were no exception—it, too, remained the same. Side clearance serves only to keep the piston ring from binding in the groove and becoming what is referred to as a "stuck ring." The stuck ring generally results from the carbon formation in the grooves resulting from incomplete fuel combustion, the buildup of combustion by-products, or excessive oil consumption.

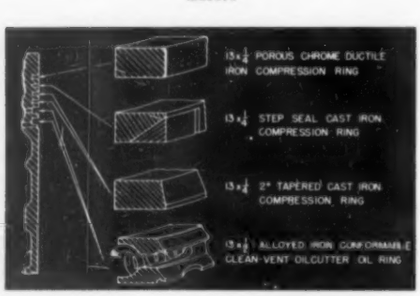
Since gas is a cleaner burning fuel, it became evident that less side clearance was required for the gas engine. Improvements in oil-control rings and consequent reduction of oil consumption also contributed to a reduction in side clearance. Therefore, after field and laboratory tests, the side clearance on gas-engine compression rings was reduced almost in half. One engine manufacturer is using 0.0015 in. minimum side clearance today with no evidence of distress. At the same time, improvements in fuel oils and/or lubricating oils have permitted the side clearance of diesel-engine compression rings to be reduced substantially. Consequently, most manufacturers of both gas and diesel engines are again making no distinction between the two in relation to side clearance.

Decreased side clearance has contributed to reduced groove wear and has prolonged the effective groove life before rework and the application of overwidth rings. The differences between the thermal expansion of the piston ring and the piston are so infinitesimal they are not considered.

The tension of a compression ring is directly proportional to the ring width; therefore, a change in ring width has no effect on unit pressure providing all other variables affecting tension remain the same. However, high-strength and high-impact, piston-ring materials have permitted a reduction in piston-ring widths without the danger of ring breakage as previously experienced with low strength, low-impact materials. This reduction of width offers several advantages when related to the engine. (a) It permits the reduction in mass of this reciprocating portion of the engine which contributes a reduction in groove wear. (b) A reduction in piston-ring drag results from the reduction of total face bearing of the piston ring. And, too, a reduction in total piston length and weight, or increased skirt-bearing area, can be established. A reduction in ring width also improves scuff resistance of a piston ring, as there is less area to lubricate—less lubrication is required.

It should be noted, however, that under abrasive wear conditions, the rate of wear of the piston ring increases with the reduction in ring width (3). Quite frequently, this increased wear is offset by the addition of a chromium plated ring or an increase in chromium plate thickness of rings which are already chromium plated.

Fig. 9 Setup for Turbo-Charged 4-Cycle Gas or Diesel Engine (13" Bore).


13 x 1/4 POROUS CHROME DUCTILE IRON COMPRESSION RING
13 x 1/4 STEP SEAL CAST IRON COMPRESSION RING
13 x 1/4 2° TAPERED CAST IRON COMPRESSION RING
13 x 1/4 ALLOYED IRON CONFORMABLE CLEAN-VENT OILCUTTER OIL RING

Design of Oil-Control Rings

In the modern low-speed and medium-speed engines, the oil rings are receiving major attention as a means of reducing operating costs by improving oil control. The oil rings, therefore, must be designed to meter the proper amount of oil for sufficient lubrication of the piston, cylinder, and rings; and yet maintain the delicate balance between inadequate and excessive lubrication. Parts which do not receive sufficient lubrication will, of course, wear excessively. On the other hand, excessive lubrication contributes to poor engine performance through excessive carbon deposits, stuck rings; and, in general, increased costs of operation. There are in operation today, many natural-gas engines which function excellently with oil consumption of about 50,000 bhp/hr per gal. This occurs with virtually no wear, and indicates perfect mating of the pistons, rings, and cylinders as to fits and surface conditions.

Unit pressure plays a most important role in oil control. As engine speeds increased, the unit pressure of oil rings has also increased. The unit pressure of the self-energized ring was increased by the use of crimped expanders. The crimped expander has today been, for the most part, replaced by the more efficient abutment-type expander, which offers more uniform unit pressure distribution. No optimum single unit pressure can be established for all oil rings in all engines since optimum unit pressure is dependent upon the ring profile and the type of service. Chrome cylinders, for instance, require a higher unit pressure using the same ring profile, than is required for satisfactory oil control in a cast iron cylinder.

Historically, the first change from the rectangular section piston ring was a change of the oil-ring profile to improve performance. Oil-ring profiles have been changing ever since. Basically, these changes resulted from efforts to improve any one or all of the requirements of a good oil ring; namely, quick seating, conformability, proper unit pressure, and the ability to maintain a uniform unit pressure as the ring wears.

Since the oil-ring requirements vary from engine to engine, the oil-ring profiles must vary to meet these requirements, Fig. 8. Some engine manufacturers have found that self-energized rings perform very satisfactorily, whereas most manufacturers have found improvements in oil consumption through the use of conformable rings. The

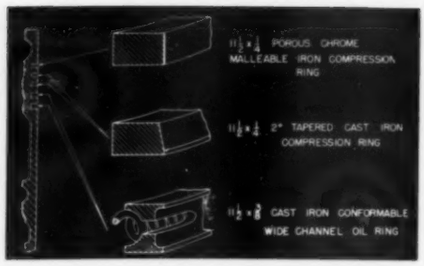

11 1/2 x 1/4 POROUS CHROME MALLEABLE IRON COMPRESSION RING
11 1/2 x 1/4 2° TAPERED CAST IRON COMPRESSION RING
11 1/2 x 3/8 CAST IRON CONFORMABLE WIDE CHANNEL OIL RING

Fig. 10 Setup for Turbo-Charged 4-Cycle Gas Engine (11½" Bore).

double-rail ring is most popular, but opinion as to the best profile for this type ring varies from rectangular rails through more elaborate profiles, which scrape oil in either direction to the unidirectional oil ring which is designed to scrape oil toward the crankcase. Regardless of the opinions of the designers, the engine is, in the final analysis, the judge as to which profile performs satisfactorily.

All agree that the side clearance of oil rings is held to a minimum to prevent oil pumping. However, the amount of drainage which should be designed into an oil ring has been a most controversial subject. Some piston-ring manufacturers, as well as some engine builders, feel that very little oil drainage is required. Still others have found that oil control has improved with additional drainage. Each piston-ring manufacturer has, therefore, established standard slotting specifications which he feels are best suited to his designs. These, of course, are quite frequently varied to meet the specifications which an engine builder has found to provide the most satisfactory performance in his engine.

An oil ring must conform to the cylinder to do an effective job of oil control. Any cylinder variation to which the oil ring does not conform will necessarily cause a variation in oil control and affect over-all performance of an engine. The conformable ring, as the name implies, was designed to improve the conformability of the oil ring by virtue of the increased uniform radial pressure exerted by the expander. Since the tension is supplied by the expander, the ring element has a lighter radial thickness which increases its flexibility and greatly improves its ability to conform readily to cylinder variations.

Oil-ring plugging, resulting from sludge buildup between the rails, in the ring slot, and in the drill holes at the back of the ring groove, is among the major factors which force premature engine overhauls. This plugging forms a solid block in the groove and between the oil-ring rails causing a drastic drop in unit pressure, ring sticking, and a complete loss of drainage so vital to efficient oil-ring performance. The source of this problem has been attributed to the fuel, lubricating oil, piston rings, operating conditions, engine design, or any combination of this group. In some cases, changes in these factors are of assistance in overcoming this problem. There are many instances, however, where sludge buildup continues despite all efforts to improve the condition. It is in these stubborn cases where a change in piston-ring profile has been helpful in reducing this tendency toward

sludge buildup in the oil rings. The addition of notches to the lower rail of oil rings has proven to be beneficial. Oil passes through these notches and dilutes the sludge sufficiently to permit it to drain back to the crankcase. Despite the notches in the lower rail, no loss of oil control is experienced since the upper rail still maintains its efficiency.

Typical Piston and Ring Arrangements

Figs. 9, 10, and 11 represent typical piston-ring setups as applied to turbocharged 4-cycle diesel engines with cast-iron cylinders. All of these setups employ a porous chrome-plated centrifugally cast top compression ring. The porous chrome surface is quick seating; and by virtue of its porosity, carries lubrication during the critical break-in period. The hard-chrome base (950 Knoop hardness minimum) establishes wear and scuff resistance of both the ring and cylinder. The high-strength, high-impact base materials virtually eliminate the danger of ring breakage.

The step-seal joint ring, as shown in the second groove of Fig. 9, seals combustion pressures at this point, thereby reducing crankcase pressures to a minimum. This joint feature also serves to restrict the by-products of combustion to the combustion chamber; which, in turn, reduces ring-belt deposits, creates cleaner crankcase conditions, and less wear on the balance of the rings in this setup. The tapered ring is the most widely applied intermediate compression ring. Its extensive use stems from its quick-seating ability and its effectiveness as an assist in oil control.

The conformable clean-vent oil cutter is applied to two of these setups, Figs. 9 and 11; this ring is the unidirectional conformable-type ring with notched lower rails described previously. The conformable wide-channel oil ring in the setup, Fig. 10, does an efficient job in this engine where proper oil control can be maintained without the use of a more severe oil-control ring. The bearing rails are rectangular in shape to maintain a uniform bearing face as the ring wears.

The trend in recent years has been toward the elimination of the oil ring on the piston skirt; thereby improving piston-skirt lubrication. The conformable ring, since that offers more positive oil control, has been instrumental in eliminating the skirt oil ring.

Fig. 12 illustrates a typical setup for turbocharged 4-cycle diesel engines with chromium-plated cylinders. All rings in this setup are manufactured of a hardened malleable iron, which was developed specifically for this purpose. Extended ring and cylinder life results from the use of hardened malleable iron through its high impact strength and wear resistance.

The two top rings are of the open-groove type. These face grooves carry some lubrication and improve scuff resistance. The unidirectional oil rings are also quick-seating and designed to scrape oil toward the crankcase. The unit pressure has been raised by taking full advantage of the higher strength and modulus, and the fine-grain structure of this material.

Fig. 11 Setup for Turbo-Charged 4-Cycle Gas or Diesel Engine (15½" Bore).

Fig. 12 Setup for Turbo-Charged 4-Cycle Diesel Engine with Chrome Plated Cylinder (9" Bore).

Fig. 13 Setup for Turbo-Charged 2-Cycle Diesel Engine (8¾" Bore).

Fig. 14 Setup for Turbo-Charged 2-Cycle Gas Engine (14" Bore).

Fig. 15 Setup for Turbo-Charged 2-Cycle Gas Engine (17" Bore).

Fig. 16 Setup for Turbo-Charged 2-Cycle Gas Engine with Chrome Plated Cylinder (18" Bore).

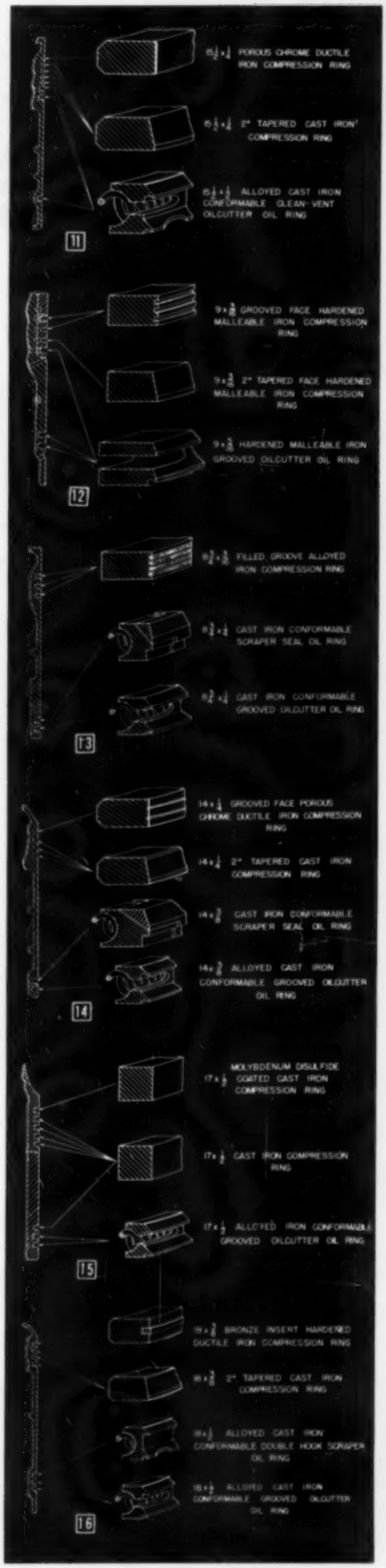
Typical piston-ring arrangements for turbocharged 2-cycle engines are found in Figs. 13, 14, 15, and 16. Note that the compression rings are different in each case; each type has been successful in service, and has been established on the basis of careful tests in the laboratory and in the field. The bronze-inserted ring is applied in chromium-plated cylinders, and has a hardened ductile-iron base material for a combination of wearing properties and strength. Face grooving for additional scuff resistance is applied to the chrome-plated ductile-iron ring illustrated in Fig. 14. The plain cast-iron ring, however, has been coated with molybdenum disulfide to furnish lubrication during the critical break-in period, and also to reduce ring and piston-groove side wear.

The intermediate rings are of both the plain-face and tapered-face types dependent upon oil-control requirements.

In all of these arrangements, there is no drilling for oil relief in top oil-ring grooves. Any drilling in these grooves would provide a direct passage for inlet air pressurized by the turbocharger directly to the crankcase. A ventilated oil ring would serve no purpose in these grooves, inasmuch as oil removed by the upper scraper would have no drainage path. Therefore, either a plain compression ring, a double-hook scraper, or a conformable scraper seal has been applied to these grooves dependent upon sealing and/or oil-control requirements. Conventional ventilated oil rings with abutment-type expanders are applied to the bottom groove.

Conclusion

Concurrent with changes in the performance standards for engines, performance standards for piston rings have become more stringent. The piston-ring industry is meeting the requirements with piston rings which have better sealing ability, better oil control, and better heat stability. Resistance to breakage and wear have been improved. While we feel that current engine requirements are being met, we are, in the materials laboratory, the mechanical laboratory, and the field, continuously developing improved rings and ring arrangements, not only to meet the demands of future engines, but to extend service life of existing engines. The success of this endeavor depends upon continuous co-operative effort of piston-ring, engine-builder, and customer engineers. We look forward enthusiastically to contributing to the advancement of the technology of internal-combustion engines.


11
POROUS CHROME DUCTILE IRON COMPRESSION RING
2° TAPERED CAST IRON COMPRESSION RING
ALLOYED CAST IRON CONFORMABLE CLEAN-VENT OILCUTTER OIL RING
12
GROOVED FACE HARDENED MALLEABLE IRON COMPRESSION RING
2° TAPERED FACE HARDENED MALLEABLE IRON COMPRESSION RING
HARDENED MALLEABLE IRON GROOVED OILCUTTER OIL RING
13
FILLED GROOVE ALLOYED IRON COMPRESSION RING
CAST IRON CONFORMABLE SCRAPER SEAL OIL RING
CAST IRON CONFORMABLE GROOVED OILCUTTER OIL RING
14
GROOVED FACE POROUS CHROME DUCTILE IRON COMPRESSION RING
2° TAPERED CAST IRON COMPRESSION RING
CAST IRON CONFORMABLE SCRAPER SEAL OIL RING
ALLOYED CAST IRON CONFORMABLE GROOVED OILCUTTER OIL RING
15
MOLYBDENUM DISULFIDE COATED CAST IRON COMPRESSION RING
CAST IRON COMPRESSION RING
ALLOYED IRON CONFORMABLE GROOVED OILCUTTER OIL RING
16
BRONZE INSERT HARDENED DUCTILE IRON COMPRESSION RING
2° TAPERED CAST IRON COMPRESSION RING
ALLOYED CAST IRON CONFORMABLE DOUBLE HOOK SCRAPER OIL RING
ALLOYED CAST IRON CONFORMABLE GROOVED OILCUTTER OIL RING

1,000,000 MILES PROVE DIESEL ECONOMY IN DETROIT TAXICABS

By JIM BROWN

IN Detroit, Michigan, a careful survey made recently of the results obtained from Perkins diesel engines in a fleet of 39 Plymouth and Dart taxicabs with total accumulated mileage of 1,191,050 miles substantiates without a doubt predictions made for them in DIESEL AND GAS ENGINE PROGRESS in May, 1959.

The survey, conducted by Checker Cab fleet operators Charles Ross and Marvin Wildt, and forwarded by letter to Chrysler Corporation officials shows that they calculate current fleet savings on fuel to be over 56 per cent (1.9¢ per mile). The letter also relates a comparison of maintenance costs on two vehicles which had been operated 63,881 mi. and 72,411 mi. respectively. Maintenance costs were 58.3 per cent less for the diesel taxi than for the comparable gasoline-powered cab, and this savings amounted to .7 cents per mi. It should be noted that this savings in maintenance was not just on the power plant alone; the figures included repairs on the entire taxicabs including tires, brakes, clutch adjustments, headlights, etc.

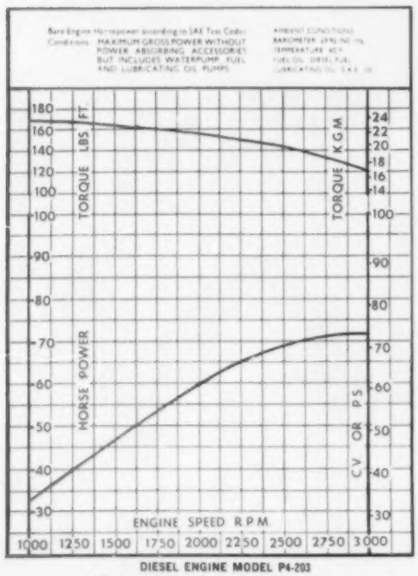
Since the bulk costs of gasoline and diesel fuel to these operators are only 1.5 cents apart, it becomes obvious that the fuel savings of the taxicabs powered by diesel engines are due almost entirely to the lesser appetites of the diesels. Where gasoline-powered taxicabs in this area require approximately a gallon of fuel for every 10 mi. of operation, the 39 diesel cabs, in their 1,191,050 mi. of service averaged 20.6 mi. per gal. Charlie Ross, in his compilation, used what he stated was their current average mileage: 21.85 mpg.

The diesel fuel consumption per cab varied considerably, from a low of 18.38 mpg to a recorded 33.5 mpg for one 1960 cab which had been driven only 4,726 miles. Extremes of this nature are the exception, however, as 32 of the 39 taxis were in the 19-26 mpg range. We suspect that some of the extremely high miles-per-gallon achievements are due to the fact that the cabs involved were delivered late in 1960 and had had no winter operation. However, cab No. 51, with the second highest total mileage of the entire group, averaged 22.77 mpg over a total of 72,815 miles, and this is very creditable performance for any taxicab.

With a savings of .7¢ per mi. on maintenance and 1.9¢ per mi. on fuel, the combined operational savings of the diesel cabs versus gasoline comes to 2.6¢ per mi. The difference in cost between a new Plymouth taxicab fitted with a Chrysler-Perkins P Four 203 diesel engine and the standard gasoline-powered package is approximately $800. At the savings indicated above, it would appear that the additional cost of the dieselized cab can be fully amortized in approximately 31,000 miles. Operation costs will vary because of many factors: fuel cost, climate, terrain, traffic conditions, etc., so that there could be considerable difference be-

Marvin Wildt of Detroit Checker Cab looks over one of the Plymouths with a Chrysler-Perkins diesel. A Dodge diesel cab is shown at upper left of this page.

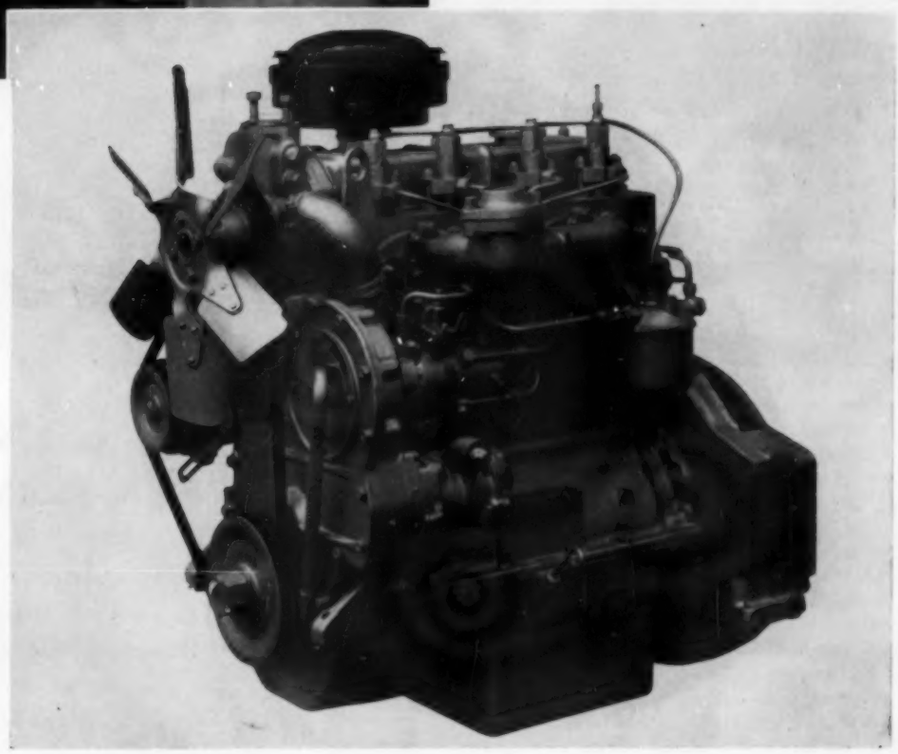
Performance curves of the P Four 203 diesel engine.



DIESEL ENGINE MODEL P4-203
203 cu. inch displacement, 4 cylinders, 4 cycle.

(L. to R.) David Viger, Charles Ross and Marvin Wildt. Mr. Viger pioneered the introduction of Perkins diesel engines into taxicabs in this country and is now Chrysler Corporation's diesel taxicab sales representative. Mr. Ross and Mr. Wildt own that part of the Checker Cab fleet that is diesel equipped.

Chrysler-Perkins P Four 203 diesel engine which now powers over 40 diesel taxicabs in the Ross-Wildt Checker Cab fleet at Detroit.



tween taxi operation in say, San Francisco and Detroit. Another widely varying factor is the average mileage per year. In New York City, for example, yearly usage is said to be as high as 100,000 mi. whereas in Detroit 48,000 to 50,000 mi. is closer to the yearly average. If the cost of "dieselizing" the Plymouth and Dodge Dart cabs in Detroit can be amortized in 31,000 miles, the subsequent savings in fuel and maintenance should average about $1,248 a year per cab. This will be a welcome assist to the taxi cab operators who have been caught in a cost vs income squeeze.

Quite pleased with the results of the Perkins P Four 203 engines in this group of cabs are the builders themselves, Perkins Engines, Ltd. of Peterborough, England, and Chrysler's Marine and Industrial Engine Division personnel. The Chrysler Corp. took over all responsibility for the sales and servicing of Perkins Diesels in July of 1960.

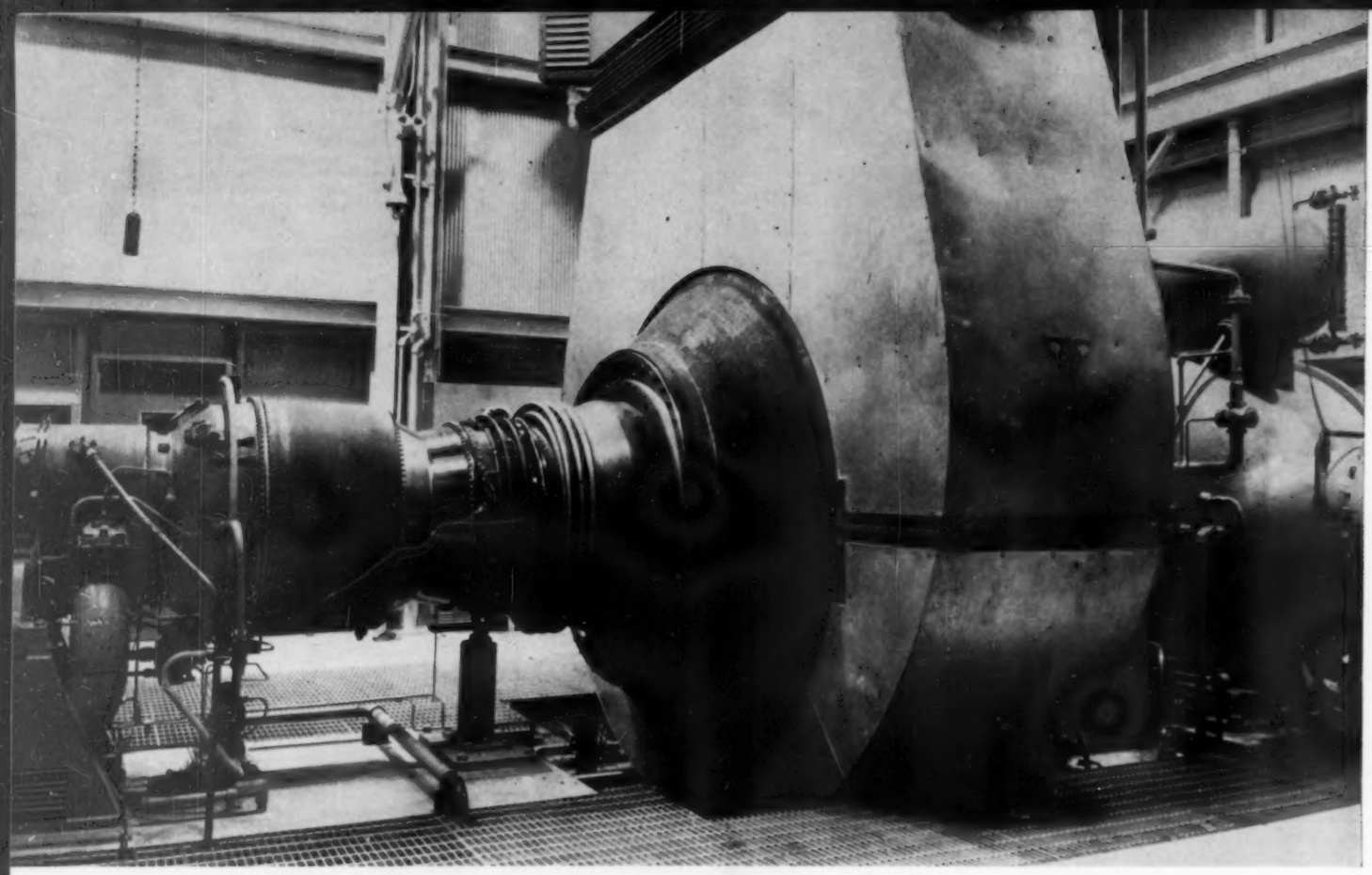
We asked W. F. Humphrey, Director of Sales of The Chrysler Corp. M&I Div., about predictions as to the possibility of rapid expansion of Chrysler-Perkins engine sales to the taxicab industry in this country. "This is a very difficult thing to predict," he said. "It depends entirely on how many fleet owners make up their minds to go diesel and how soon they do it. We believe that the interest being shown in diesel taxicab sales by Plymouth and Dodge dealers all over the country will stimulate such sales considerably. The fact that taxicab operators will know they have immediate service and parts available through these dealers will also reinforce their decision to 'go diesel'."

Mr. Humphprey went on to point out that whereas only about 100 of the diesel taxicabs had been sold with Perkins engines in the last year, they hope to install at least 500 of the Chrysler-Perkins engines in new Plymouth and Dart taxis during the next 12 months.

CHRYSLER-PERKINS

Diesel Powered Plymouth and Dart Taxis now operating in the following cities:

CALIFORNIA
Los Angeles
FLORIDA
Miami
ILLINOIS
Chicago
INDIANA
Evansville
Gary
Indianapolis
KENTUCKY
Louisville
MASSACHUSETTS
Athol
Boston
MICHIGAN
Detroit
Grand Rapids
NEW JERSEY
Trenton
NEW YORK
Buffalo
New York City
OHIO
Cleveland
Toledo
PENNSYLVANIA
Philadelphia
TENNESSEE
Memphis
VIRGINIA
Portsmouth
WASHINGTON
Seattle



RT-248 JET DRIVEN GAS TURBINE NOW IN GAS PIPELINE OPERATION

New Cooper-Bessemer 10,500 HP Turbine-Centrifugal Begins Operation Near Clementsville, Ky. on Columbia Gulf Mainline; Power Unit Is First of Series to Range from 350 to 15,000 HP

By ROBERT E. SCHULZ

CHICAGO, Ill. November 15—Before a closed circuit television audience today, a new and unique form of gas pipeline transmission power was demonstrated in full operation. This is the Cooper-Bessemer RT-248 gas turbine, and the Mount Vernon, Ohio company, together with Pratt & Whitney Aircraft and Columbia Gulf Transmission Co. staged the presentation.

We in Chicago were linked with similar groups of press and pipeline personnel in New York, Houston, Los Angeles and Washington, D.C., the latter being the originating location. Of immediate concern was the initial operation of the new Cooper-Bessemer jet driven gas turbine driving a centrifugal gas booster at the Possum Trot station on Columbia Gulf's main line system, outside Clementsville, Kentucky. The station is now in 24 hr./day service and is pumping about 600 million cu. ft. of natural gas a day.

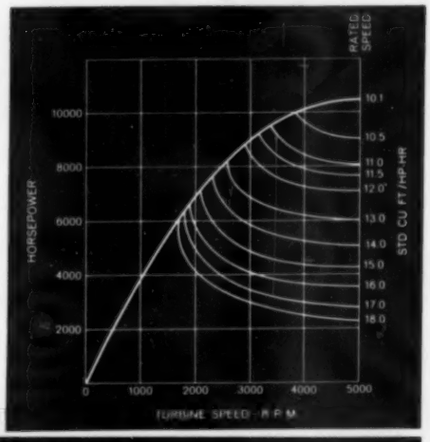
The RT-248 was fully described in the November, 1959 issue of DIESEL AND GAS ENGINE PROGRESS, but let's briefly review its construction and operating features. Designed by Cooper-Bessemer, the turbine is rated 10,500 hp for this service. It consists of two major components—the power turbine and the gas generator. The gas generator is supplied by Pratt & Whitney and is a modified commercial version of its highly successful J-57 jet aircraft engine set up for burning natural gas. It is of the two-spool design, operates at a compression ratio of 10:1, and is coupled to the power turbine with a bellows type expansion flange (there is no mechanical drive connection between the two units). The power turbine, designed and built by Cooper-Bessemer with the cooperation of Pratt & Whitney, is a two-stage unit. It weighs about 20,000 lbs. compared to the approx. 4000 lbs. weight of the gas generator. Design of the power turbine incorporates a vaneless diffuser exhaust duct thereby dictating the relatively large diameter. The turbine blades are self-dampening design to absorb vibration throughout the speed range of 0 to 5,200 rpm. The RT-248

This view inside the new compressor station near Clementsville, Ky. shows the arrangement of the gas generator, power turbine and compressor. Developing 10,500 hp, the Cooper-Bessemer RT-248 has installed weight of 34,000 lbs.

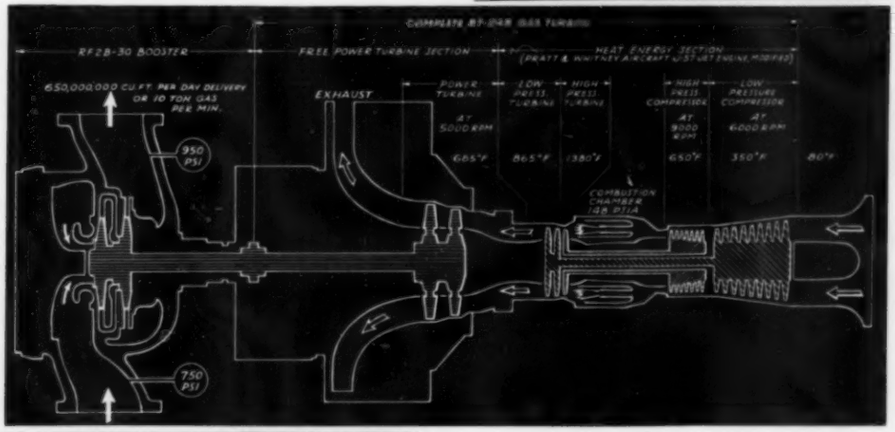
jet gas turbine, it is stated, obtains a thermal efficiency of 25 per cent without regeneration equipment substantially through the higher pressure ratio of the gas generator component.

Installation near Clementsville is considered experimental, and is a cooperative venture by Cooper-Bessemer, Columbia-Gulf and Pratt & Whitney. Quoting from Sy Orlofsky, vice-president of Columbia-Gulf, "it is basically a long-range management decision to balance present with long-range goals—it is today's decision for tomorrow's results." The complete 10,500 hp jet gas turbine station is estimated to cost $1,988,700 or $190 per installed horsepower. The main objectives of the experiment are to determine by actual construction and operation, the economics and feasibility of the installation and the reliability of the jet gas turbine as compared to other forms of power utilized to transport natural gas. As now scheduled, the test will be conducted for 8000 hrs. of actual operation or an 18 month period, whichever comes first. As this article is written, the unit was approaching 350 service hours. As a side note, Pratt &Whitney has over 19,000 of its J-57 jet engines in service, both in military and commercial use, throughout the world. Experience has shown excellent reliability and low maintenance cost. Company officials fully expect the experimental RT-248 jet gas turbine installation in the Columbia Gulf system to operate with similar, if not lower, results. This they believe because the RT-248 turbine for gas transmission application will not be required to perform through the continuously varying load and overload conditions considered normal performance for aircraft jet engines.

The installation at Possum Trot is on the same site as a seven unit, 14,000 hp C-B angle-reciprocating compressor station, but the turbine-centrifugal is housed in an entirely new building. The RT-248 required a rather simple foundation averaging about 52 lbs. of concrete per installed hp, and 0.12 sq. ft. of floor space per installed hp. As illustrated, the turbine is controlled by the Cooper-Bessemer En-Tronic system and presently the station is on a local-automatic operation basis. By next spring, this and the other nine stations on Columbia Gulf's mainline, totalling 155,300 installed horsepower, will be run automatically and unattended. Control will be centered at the company's Nashville, Tenn. operation headquarters. According to officials of the pipeline in Chicago, the RT-248 now is handling the entire station load. It is stated that from a cold start, the RT-248 takes approx. 24 minutes to come up to load.



Fuel consumption curve of the new Cooper-Bessemer gas turbine.



Operating diagram of the RT-248 driving a Cooper-Bessemer RF2B-30 pipeline booster as installed on the Columbia Gulf main line.

Attractive exterior of the Possum Trot station which was completed in November, 1960. No intake air filter is employed for the RT-248.

En-Tronic control board provides for complete automatic operation of the RT-248. The station is presently on local-automatic, but will be switched to remote from Nashville, Tenn. shortly.

This time is reduced to 12 minutes, starting after a short shutdown. At present, 8000 hrs. have been set as the expected overhaul time for the gas generator. At this time the unit would be completely removed and a spare or replacement unit set in place. Four hours for changing the gas generator is considered conservative considering that the airlines are able to replace a comparable jet engine in some 45 minutes.

Authorization to construct and operate the experimental jet gas turbine station was granted Columbia Gulf by the Federal Power Commission on December 28, 1959. Site preparation was started April 8, 1960, and the turbine was operated for the first time May 27, 1960 at the Wilgoos Laboratory of Pratt & Whitney at East Hartford, Conn. Tests were concluded on July 13 after which the machine was shipped to Clementsville for installation. Here the turbine was started for its initial testing in October.

All three of the participating companies know that the next 12 to 18 months at the Possum Trot station will provide many of the answers to the operating and maintenance questions about the RT-248 gas turbine. Cooper-Bessemer and Pratt & Whitney, while concentrating directly on this application, are also engaged in developing other areas of service. During the interview session of the telecast, Ralph L. Boyer, vice president and director of engineering at Cooper-Bessemer, predicted that other applications would be announced in the next 12 months. It is believed the second installation will be for electrical power generation, however, the unit is also considered to be well suited for marine propulsion, crude or products pipeline pumping, and for general power service in chemical and petro-chemical processing. The RT-248 itself is the first of a family of jet-powered gas turbines ranging from 350 to 15,000 hp.

COTTONSEED PROCESSOR TRIMS COSTS, BOOSTS OUTPUT WITH CHANGE TO DIESELS

By KENNETH R. MACDONALD

DIESEL engines used in a unique "blowing" operation have helped cut maintenance costs, increase efficiency, and boost production for Ranchers Cotton Oil Co., a Fresno, Calif. firm which less than 10 years ago was merely a glimmer in the mind of a group of imaginative leaders of the rich cotton belt girdling Fresno in the heart of California's San Joaquin Valley. The youthful company, directed by general manager Earl J. Cecil, with E. D. Hudson as plant superintendent, was founded primarily to yield to its grower members 100 per cent of the returns from their cottonseed. The owners are the members who deliver their cottonseed to Ranchers' mill in Fresno where the company annually processes 170,000 tons of cottonseed from which is produced more than 1,000 railroad cars of premium cottonseed oil.

"During most of 1960," explains general manager Cecil, "we have worked like beavers to double our plant capacity, with all of the design and construction of the plant handled by members of our own organization."

A major part of Ranchers' expansion program has involved a substantial conversion from gasoline engines to diesel engines, according to Plant Superintendent Hudson. As a result, Ranchers' Cotton Oil Co. operations are now powered by an International UD-817 and five International UD-554 diesel engines, installed by Fresno's Allied Equipment Co. to run Ranchers' blowers made by Hubert Phelps Machinery Co., Little Rock, Ark.

"When we first got started in 1951," Mr. Hudson points out, "we had only 10 members whose 14 cotton gins produced 48,000 tons of seed. Today there are 26 corporate members and 3 non-members, totalling 63 gin outfits and the output of Ranchers' cottonseed has more than tripled, from the 48,000 tons in 1951 to more than 170,000 tons today. "Solvent plants for cottonseed," Hudson points out, "were something brand new when Ranchers started in 1951 and the first one had been put into operation only three years earlier, at Wilson, Ark. The big advantage of such plants is that they will extract from 25 to 40 lbs. more crude cottonseed oil from a ton of cottonseed than can be obtained by mechanical presses alone."

When cottonseed arrives at the Fresno plant from the various members' gins, it is either stored in huge covered piles of 14,000 tons each, or in metal warehouses. The piles are equipped with air ducts to aerate and preserve the seed and with thermocouples throughout to flash warnings of any "hot spot" that might lead to sudden deterioration in the seed. Ranchers' has two metal warehouses, each with a capacity of 16,000 tons of cottonseed. One feeds each lint room and the warehouses are advantageous when it rains and as a "hospital house" for seed that requires immediate milling because of rain damage prior to ginning.

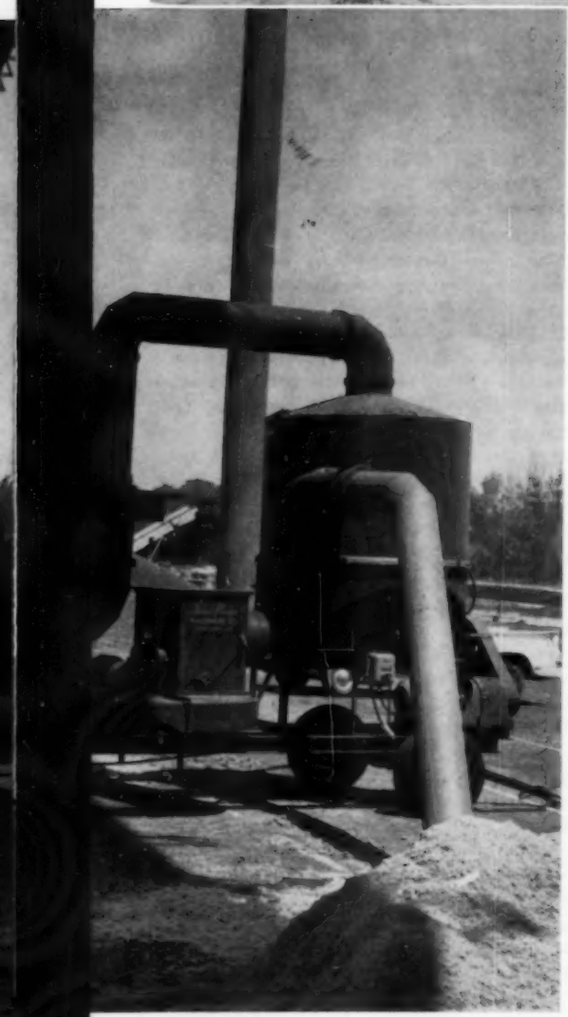
The entire annual cottonseed quota is trucked into the plant during a highly concentrated work period of 30 to 45 days. The seed from which the company manufactures oil and meal is then stored for use during the 12 month production season. "This current season Ranchers received 200,000 tons of seed which will be run through

International UD-817 "blows" cottonseed through pipes from stockpiles to processing plant. Engine drives blower through clutch and Falk coupling. Seed is conveyed to air pipe on suction side of fan, into the cyclone, then fed to discharge air stream of fan through screw conveyor. UD-817 blower unit is wheel-mounted for portability. Engine is rated 200 cont. hp at 2100 rpm.

Air view of Ranchers Cotton Oil plant shows seed stockpiles, processing plant at left center.

Ranchers plant is well-equipped. Delinting machinery above is first stop in processing cottonseed for oil, by-products.

Air is pulled through ducts in stockpile by fans driven by International UD-554 diesel engines. Engine is direct-connected to rubber-bladed fan. Ducts are spaced every 45 ft. in pile; air prevents formation of "hot spots" which would deteriorate seed.



the plant at the rate of 600 tons per 24 hour period. The plant, incidentally, runs 24 hours a day, 7 days a week, 330 days of the year. We close down about one week every three months for maintenance, and are constantly attempting to reduce this maintenance close-down time just as much as possible," Mr. Hudson said.

As many as 250 trucks arrive at the plant each day. Ranchers can handle a truck every two minutes, even though the trucks are weighed twice. "Thus you can see," Hudson told us, "that storage of the seed is of prime consideration. Because of the ideal climatic conditions in this area during the harvest season, the seed is received in a dry condition and can be stored in our outside piles.

"These 14,000 ton piles are 50 ft. high by 100 ft. wide by 385 ft. in length," Hudson went on. "After piling, the seed is covered with 12x85 ft. tarps fastened to 2x4 rafters on 6 ft. centers supported by 2x4 stakes driven into the seed. This covering protects against the winter rains which come in December, January and February."

Cottonseed arrives from the gin at about 100° F. This elevated temperature is detrimental to the end product if it is maintained for long periods of storage and under certain conditions of moisture, the seed will sweat and heat. "To overcome these difficulties," Hudson said, "we reduce seed temperature to about 60° F., depending on the outside air temperature, by pulling cold air from the outside through the seed. This is done by ducting air from a large rubber bladed fan, driven by a diesel engine to a system of wooden air lines buried in the seed pile. These fans formerly were driven by gasoline powered engines which were loaded so closely to their rating that a complete engine overhaul after 6,000 hours was essential every two years. We also had considerable valve trouble at about 1,400 hours per head.

"The gasoline engines," Hudson points out, "have been exchanged for the International model UD-554 diesels. "With diesel fuel economy coupled with the cost of diesel fuel being about one half that of gasoline, we have found that we can pay for the difference in initial cost of the two engines in only a year's time." The UD-554 is a 6 cylinder, four cycle engine with 4⅝ x 5½ bore and stroke and rated 108 cont. hp at 1800 rpm. To date, Hudson reports, the company has experienced no major troubles with its diesel engines, some of them now in their third season.

"When removing the seed from the piles into production," Hudson said, "we use a pneumatic system which is powered with a dual rubber bladed fan driven by the UD-817 diesel. On this operation we also formerly used a gasoline engine. With 5⅝ in. bore and 6 in. stroke, the UD-817 is rated 200 cont. hp at 2100 rpm. Our experience with the UD-817 diesel has been exactly the same as that with the diesel engines powering the single fans, greater economy, more efficiency and longer life," Hudson said.

The UD-817 powers a blower, dust collector assembly through a clutch and flexible coupling to force the cottonseed from the big stockpiles to the storage bins in the seed house, some 700 yards distant. A 12 in. diameter pipe is used for this purpose. The UD-554 diesels are used on similar blowers to aerate the fresh cottonseed. As part of the never-ending maintenance required in its plant, Ranchers has a completely equipped machine shop, stocked with spare motors and other parts to enable personnel to make repairs at any hour of the day or night.

DIESEL SERVICE PROGRESS

A COMMENTARY BY **GEORGE R. MACKEY**

George R. Mackey was long associated with Detroit Diesel Engine Division of General Motors Corp., and had prior experience as a mechanic in Europe and the U.S.A., which enabled him to become well acquainted in the diesel and service fields and to obtain a broad scope of the service industry from the customer's and management's viewpoint. Further training at Carnegie Tech and in the Army Ordnance during World War II provided the necessary requirements in planning service programs. Progressive advancement in diesel service areas in General Motors and with Detroit Diesel led to his position as Supervisor of Service Promotion. Upon termination of employment with General Motors in 1952, he joined Clayton Manufacturing Company, and his present position with this organization is Sales Manager of the Dynamometer Division.

Diesels and Superchargers

SINCE the introduction of the diesel engine to the world of power, engineers have diligently worked to obtain the most satisfactory horsepower vs. weight ratio consistent with performance, economy and engine life. During early development, it was recognized that, by affecting better engine breathing and crowding more air into the cylinder, a greater volume of fuel could be burned with a resulting higher horsepower. Hence, the history of the diesel includes various adaptations of blowers and superchargers. Possibly the types which we have been more familiar with in the past are the Roots blower and the centrifugal blower. Each of these blowers is classified as a supercharger when applied to increasing volumetric efficiency of a naturally aspirated engine.

In our modern families of diesel engines the Roots type blower is possibly the earliest form of supercharging experienced in any volume. This unit uses a positive displacement pump arrangement where air is trapped between the rotor lobes and blower housing on the inlet side and forced out under pressure, at the outlet port, by the rotation of the rotors. Straight rotor lobes were used on the earlier adaptation of the Roots blower and are still used on some smaller high speed engines. To minimize noise and pulsating air flow on the larger engines, helical shaped rotors became the accepted type for most requirements. The most popular application of this form of blower, during the last decades, is on high-speed diesels operating on the two cycle principal. For this application it is used primarily to scavenge the burned gases from the cylinders at the completion of the power cycle and to provide a fresh charge of air in the cylinder for the next cycle. The actual air "boost" to the cylinder is practically negligible. But even though the air in the cylinder may not be much above atmospheric pressure, the end result is very effective due to complete scavenging and absence of "left over" exhaust gases. When the Roots blower displacement is properly matched to an engine, it provides good low speed boost without a very great blower step-up speed, generally around 2:1 or less, of engine speed. This type of blower, while fulfilling the requirements for many applications, does have certain limitations. Two of these may be worthy of consideration: the fall-off of efficiency at higher rpm; and the increase in required power to drive it at higher speeds.

Another form of blower used to create a great flow of air to the engine is the fixed ratio centrifugal blower. Actually this type of blower is relatively simple, consisting of a multi-bladed impeller turning at a fairly high speed in a housing which directs the flow of air from the impeller tips to a collector tube or housing, which directs the flow to the engine. As air is forced out toward the impeller tips by centrifugal force, a partial vacuum or lower pressure area created at the center allows more air to flow in through the inlet passage. This simple, light weight blower provides good efficiency at high speeds, but does not compare with that of the Roots blower at lower speeds. Also, due to various structural requirements there is a limitation on the step-up speed, generally in the neighborhood of 10, 12 or 15 times engine speed.

Application of these forms of blowers for supercharging purposes resulted in considerable research to seek an even better approach. During this period a number of desirable characteristics of the ideal supercharger were set forth by engineers and manufacturers. From this the following requirements were determined: the supercharger must be a production item, economic to build and maintain; it must deliver a significant air pressure boost at low engine speeds without developing excessive impeller rpm at high engine speeds; it must operate within a satisfactory noise level; it must have a useful life proportionate to engine life; and, for control of manufacturing costs which are naturally reflected on the unit sales price, one model must be suitable to a wide range of engine models and applications. The type of supercharger which appeared best suited to most requirements was the "turbocharger."

The turbocharger or turbosupercharger is a turbine type device, the turbine being driven by engine exhaust gases. In operation the gases from the exhaust manifold drives a turbine which actuates a centrifugal air compressor. The turbine wheel and the compressor impeller are mounted on a common shaft, with no mechanical drive connections to the engine. One of the prime virtues of this type supercharger is that no crankshaft power is required to operate it. Mechanically it is one of the simplest types of chargers available, and with increased production and acceptance it should be the most economical to purchase and maintain.

The centrifugal compressor portion of the turbocharger consists of two elements, the impeller or rotor and the diffuser. The work performed, that of increasing the air flow, is done by the impeller and a large portion, 50 per cent at least, of the pressure rise takes place in this section. The diffuser converting the velocity head of air provides the remaining pressure rise. While there are various types of impellers in use, shrouded types and open types, each having various blade configurations, diffusers may or may not incorporate blades or vanes. The turbine section of the turbocharger also consists of two elements, the nozzle and the wheel. The nozzle is ring shaped with small orifices aimed inward to produce a spiral or vortex flow of exhaust gas. Because the orifices or nozzle openings are small, compared to the exhaust gas volume, a vortex of extremely high velocity is created.

The turbine wheel, mounted inside the nozzle, is driven at high speed by the action of the exhaust vortex flow. The speed of the turbine is determined by the nozzle vortex flow velocity and the driving power developed. The turbocharger can be made to operate faster or slower by varying the velocity of the vortex flow which drives the turbine. A smaller nozzle will accelerate the exhaust gas to a high vortex velocity and drive the turbine faster; a larger nozzle will lower the vortex velocity and result in slower turbine speeds. This is the principal means employed to match a given size turbocharger to an engine. In the power plant area of the turbocharger the nozzle is the device that demands energy from the engine exhaust. Any and all effects which increase the nozzle vortex will provide increased power to the turbine.

Without going into great detail over air temperature, driving forces, density ratios, scavenge pressure differentials, etc., we can see that the horsepower increase for a given supercharged engine, at sea level, increases in almost direct proportion to the amount of air inlet pressure boost. Atmospheric pressure, for practical illustrative purposes, is generally referred to as 15 psi, or one atmosphere. Therefore, an increase in charging pressure of 15 lbs. above atmosphere will double the air supply and provide the necessary ingredient for doubling an engine power output. Because the internal friction within the engine remains practically unchanged from when the engine was naturally aspirated, the actual power gain could even be higher, but the higher intake air temperature and other contributing factors may have some effects which would counteract the addition, and bring the total power rise close to the 100 per cent level.

The effective results of turbocharging at altitudes brings an altogether new set of correction factors into consideration. For a naturally aspirated engine we usually consider 3 per cent power loss for each 1000 ft. altitude above that for which the engine is rated. This would not be true for turbocharged engines. The efficiency of a turbocharger increases with the lighter air density of higher altitudes. This could compensate for the usually lower volumetric efficiency experienced with engine operation at higher altitudes, so that engines may easily develop their sea level power rating at altitudes of 5000, 6000, 8000 ft. and even higher. Specifications for these conditions are generally furnished by the manufacturer. At lower altitudes the additional fuel which can be burned, because of the overabundant quantity of air in a supercharged engine, will naturally result in greater power and cleaner exhaust.

While the earlier diesel engines were generally large heavy pieces of machinery, modern design, better metallurgy and better engine breathing have resulted in greater horsepower per pound of engine. With the application of superchargers, we can look forward to even more horsepower per engine unit size. This will open many new doors to the industry. We may expect to see the diesel engine accepted in many fields heretofore considered improbable and impractical, providing service is able to do its part and be capable of coping with new responsibilities and maintain increased hp from smaller, more conplex engines.

Erie Forge Sales Manager

W. J. Vonah

Appointment of W. J. Vonah as general manager of sales is announced by Homer C. Lackey, president of Erie Forge & Steel Corp., in Erie, Pa. Mr. Vonah assumed his new position and responsibilities effective October 1, 1960 and will make his headquarters at the Erie works. He formerly had directed sales for the company in its New York and New England territories.

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V-8 ENGINE HELPS SPEED ALASKA RUN

A "DIVIDEND" in improved fuel mileage was an extra benefit for a tractor owner-leasor who repowered his St. Paul-to-Alaska diesel tractor with a Cummins V8-350 diesel engine.

Ray Degross, who leases his Mack B77 tractor to Arctic Express division of Watkins Motor Lines, Inc., was looking for added power for the tough run when he decided to replace his NRTO engine with the V8-350. But the new engine not only gave him added power and cut running time for the 4000 mi. trip but his fuel mileage improved from the former 5 mpg to 5.7 mpg on his first two trips to the newest state.

The Alaska run has always been a tough one, even with the Alcan highway, for driver and truck. The trip can be rugged: no service facilities, fueling stops are few, 1300 mi. of the road are gravel-surfaced (with "gravel" consisting of stones up to six in.), hairpin curves, 13 mi. hills, poor weather—the works. Every adverse condition can be encountered on the run and the driver seldom knows just what's coming next.

Paul Rhodes, chief of Arctic Express, is responsible for keeping the trucks moving. Degross was anxious to get the biggest engine practicable for his run and stated, after his initial trips with the new unit, that he especially liked the tremendous rpm's he had to "play with" in the V8-350. The new engine was installed by Cummins of St. Paul. The installation makes a neat package: neither body, fenders or radiator required reworking to fit the engine. The top lip of the frame was dropped one inch for a length of one foot, resulting in a three inch clearance around the manifolds. The rear engine mounts were brought forward six inches and a new U-shaped front mount was fabricated to provide three point suspension. The engine is about two inches higher than the NRTO it replaced so the main transmission was raised two inches and the auxiliary about one and three-quarter inches. This engine, introduced by Cummins in 1960, has bore and stroke of 5½x5 in. and is rated 350 hp at 2500 rpm.

The new V8-350 engine made a close but comfortable fit in the Mack B77 chassis. The engine was installed with only minor modifications of the frame. Location of the fuel pump, other accessories in the Vee make servicing easier.

Maintenance of the V8-350 is easier because the fuel pump and compressor and all other accessories are mounted in the 90° angle formed by the cylinder banks. The only other change made for the installation was moving the steering gear 20 in. by changing the angle of the U-joint. Degross said he actually prefers the new position of the wheel.

The V8-350 drives through a Mack TR720, 10 speed transmission; Spicer 8341 A auxiliary transmission and 5.08:1 rear axle. While this combination gives a top geared speed of over 90 mph, the direct drive through the transmission and auxiliary gives about 60 mph. Degross reported that on one 13 mi. hill the truck gets no lower than third gear in main transmission and direct in auxiliary while some 250 hp trucks must drop down as far as first direct.

Arctic Express is one of several divisions of Watkins Motor Lines, Inc., of Thomasville, Ga. Watkins has 217 trucks on an owner operator basis in 43 different states. The firm started to specify diesel engines in the leased units in 1955, by 1958 all were changed over.

"On the last trip southbound," said Paul Rhodes, "this truck was the only one able to get through. Some of the trucks were tied up as long as three days waiting sanding of the grades so they could get over since their power was inadequate to make it without aid."

Owner Ray Degross drives this Mack B77 tractor to Anchorage, Alaska on regular run with Arctic Express division of Watkins Motor Lines. Note Winslow lube oil filter forward of the fuel tank.

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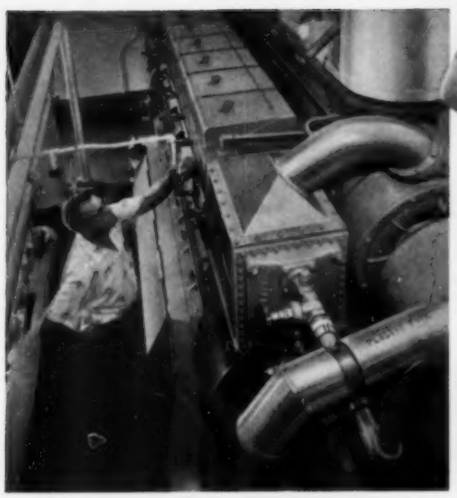

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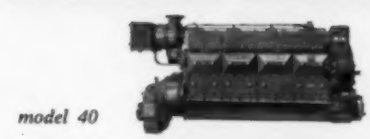
**Supporting case histories furnished on request.*



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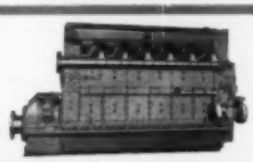

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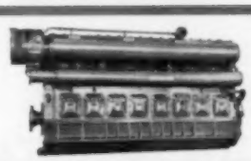
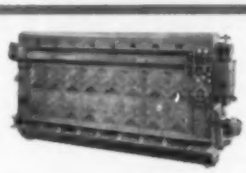


model 65



model 80

			Naturally Aspirated		Supercharged	
Model	Cylinders	RPM	HP	KW	HP	KW
40-6	6	600-1100	215-460	150-315	325-775	225-540
40-8	8	600-1100	290-620	200-425	435-1025	300-700
60-6	6	360-514	410-530	290-365	615-950	415-650
60-8	8	360-514	515-705	350-500	875-1250	600-825
65-6	6	500-600	580-720	400-500	1105-1600	760-1120
65-8	8	500-600	775-960	530-650	1470 2150	1025-1500
80-6	6	300-375	600-780	400-540	900-1450	625-1000
80-8	8	300-375	800-1040	550-700	1200-1900	800-1250

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White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

$1.7 Million Cummins Addition

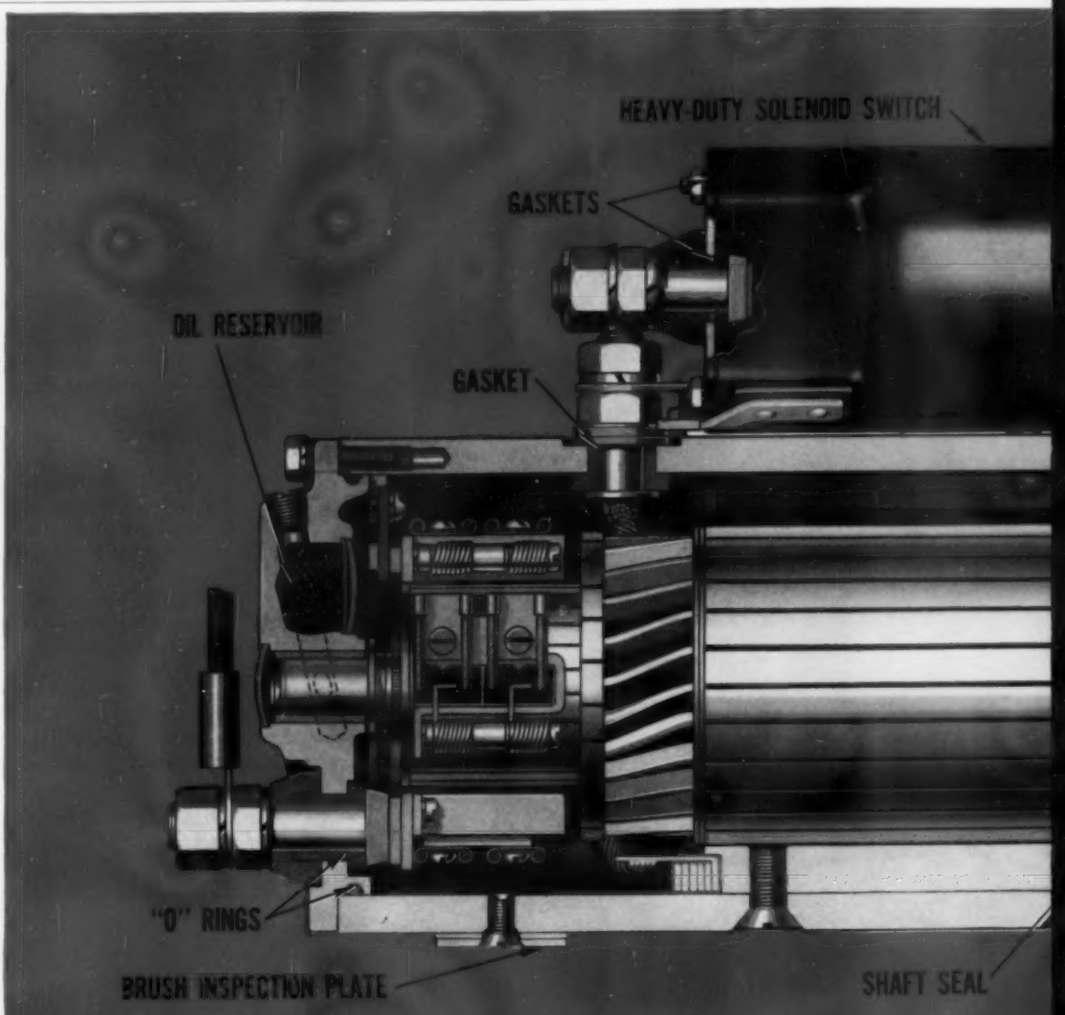
Cummins Engine Company, Inc., Columbus, Indiana, has announced plans for a $1.7 million addition to its manufacturing facilities. Construction on the building which will house all engine assembly functions started in November, according to E. D. Tull, president. Completion is scheduled for August, 1961. The new facilities will provide 101,600 sq. ft. of additional floor space, increasing the total building area at the Columbus site to over 1,000,000 sq. ft. Also providing machining facilities for cylinder blocks and cylinder heads, the building is designed to streamline the entire Cummins production line. Engine handling between the conveyorized assembly area and engine test will be substantially reduced. Assembly of the Company's "H", "J" and "V" series engines will be housed in the new building. The assembly area will be completely air conditioned to insure clean and most favorable working conditions for precision assembly operations. Two of the four assembly conveyors will be power operated. The building will be the Company's second largest single structure. This is the second major building expansion by the Cummins firm at its Columbus plant during the past two years. The Company completed construction of a $5,500,000 engine test and shipping area in July, 1960. That 300,000 sq. ft. addition is the largest single building at the present site. With completion of the new facilities, the Company and its wholly-owned subsidiaries will have spent over $55,000,000 on new machinery and facilities since 1950. Major aspects of this program have included expansion and modernization of the Cummins research laboratory in 1955, opening an engine manufacturing plant in Shotts, Lanarkshire, Scotland in 1956, completion of a 73,600 sq. ft. machining facility in 1957, purchase of the Atlas Crankshaft corporation in Forstoria, Ohio in 1958 and establishment of a filter manufacturing plant in Seymour, Indiana, also in 1958. Cummins also opened a plant for the manufacture of service parts in Sao Paulo, Brazil in 1959, and recently announced plans for an engine assembly plant near Melbourne, Australia.

Newell Heads SNAME

At the 68th annual meeting of The Society of Naval Architects and Marine Engineers, John Rogers Newell was elected president of the Society for a two-year term starting January 1, 1961. Mr. Newell is president of the Bath Iron Works Corp., Bath, Maine. He succeeds Rear Admiral Albert G. Mumma, USN (Ret.), who is Vice-President-Engineering of the Worthington Corp. Mr. Newell has been a member of the Society since 1938, has served on the Council and the Executive Committee, and has just finished a three year term as Vice-President. He has been active in Society affairs on various committees. This is the first time in the 68 years of existence of the Society that a son of a past president has been elected to the office of president. In 1945-1946 Mr. Newell's father, William S. Newell, served a two year term as president.

Solar Promotions

Paul A. Pitt has been elected vice president-engineering of Solar Aircraft Co., a subsidiary of International Harvester Co. Mr. Pitt heads Solar's engineering and research activities. At the same time, Sumner Alpert was named manager of a new division which includes Solar's aerospace, ground support and industrial products, with responsibility for sales and project engineering in these areas. Mr. Pitt has been Solar's chief engineer since 1955. He did pioneer work in the development of small gas turbines and afterburners dating back to the 1940's and has published several papers on these subjects. Mr. Alpert, formerly chief technical engineer, joined Solar in 1951.



Another first from Delco-Remy!

NEW DELCO-REMY HIGH-OUTPUT MOTOR

Completely new series of high-output cranking motors! These 12-volt motors have the torque and speed to do the same job as 24-volt motors of equal size *and on the same battery power.* No need for series-parallel switches and their complicated wiring on engines up to 900 cubic inches. These solenoid-operated, over-running clutch type heavy-duty cranking motors come with special two-piece drive housings that permit 24 different motor mounting positions. Their new 50% longer brushes, together with sealing rings (optional) and large oil reservoirs (optional), assure extra-long operating time between overhauls.

TOTALLY ENCLOSED DRIVE SHIFTING MECHANISM is protected against dirt, water, slush and ice. This enclosure, plus the shaft seal and linkage seal, also blocks transmission oil leakage into the motor and solenoid.

TWO-PIECE DRIVE HOUSING DESIGN permits 24 different solenoid positions which allows greater standardization—cuts fleet inventories. Nose housings are available in S.A.E. #2 and #3 mountings.

HEAVY-DUTY SOLENOID AND SWITCH provide positive pinion engagement and safely handle maximum starting current. Special seals keep out foreign material and allow increased contact life.

Power Takeoff Bulletin

The P-200 flywheel power takeoff, operable at both full torque and a 1.27:1 ratio, is described in a four-page, four-color bulletin offered by Clark Equipment Company's Transmission Division. Dimensions are indicated on transverse and longitudinal scale drawings, and the unit is illustrated by a cut-away photograph and a drawing of the power takeoff installed between transmission and engine. A cut-away drawing shows arrangement of gears and shafts. A variety of applications is suggested and illustrated. Design features and tips on application are included. For copies, write P-200, Clark Equipment Co., Transmission Division, Jackson, Mich.

ITS NEW

New Diesel Concentrate

Development of a new diesel concentrate (ashless dispersant), specifically formulated for diesel engines and diesel fuel, is announced by Behnke Lubricants, Inc. The new dispersant, JAX DC #5 diesel concentrate, when added regularly to the diesel fuel, is said to cut downtime by 80%, eliminate reverse flushing of injectors, more than double injector life, and prevent formation of gum or lacquer on injector plungers, as well as preventing the plugging of injector cups and metering holes. It is also claimed to reduce excessive exhaust stack smoke to a minimum, and disperse moisture and keep fuel lines open. The new concentrate is not an upper cylinder lubricant according to the manufacturer. For complete information on JAX DC #5 diesel concentrate, write Behnke Lubricants, Inc., Box 3006, Milwaukee 18, Wis.

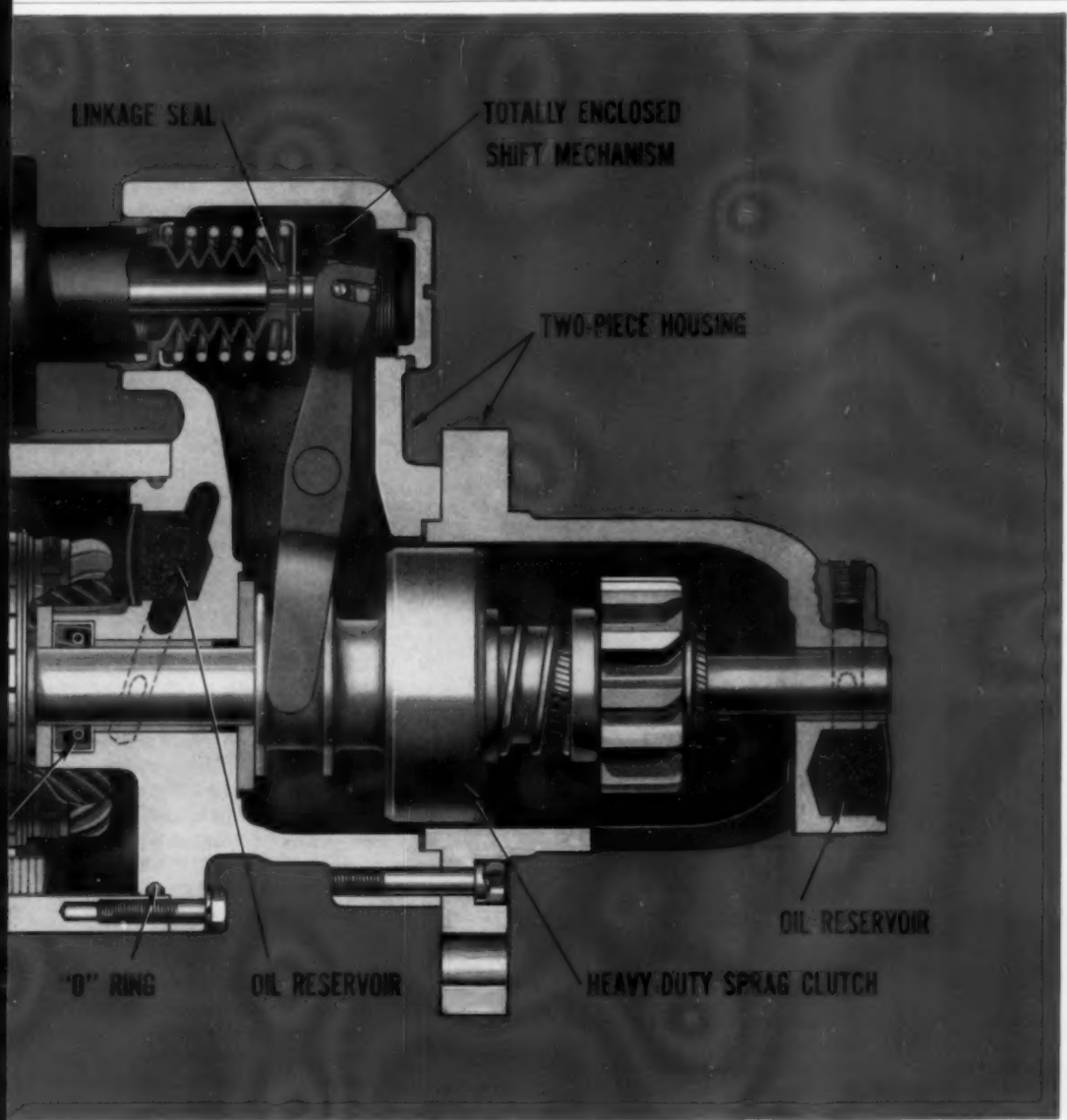
ITS NEW

Standby Training Course

Installation, operation and maintenance of standby diesel-electric sets are subjects covered in a specialized training course now offered by the Detroit Diesel Engine Division of General Motors. The course is an addition to Detroit Diesel's regular service training program and is held at the Division's Training School in Detroit. The course is open to personnel of public utility companies, radio and television stations, hospitals and other institutions who maintain or plan to install this type of equipment for emergency standby use. Covered are all features of the Division's Series 71 engine including design, disassembly and assembly, trouble-shooting and tuneup procedures. A partial list of other subjects covered includes generator design and construction, generator trouble-shooting, voltage regulation and automatic starting and shutdown. The duration of the complete course is two weeks with classes limited to 12 trainees to permit maximum participation in laboratory sessions. Details on the course and open dates available can be obtained by writing the Detroit Diesel Engine Division, Product Service Training School, 13400 W. Outer Drive, Detroit 28, Mich.

Nugent Representatives

Mr. F. L. Townsend, sales manager of Wm. W. Nugent & Co. (Inc.), Skokie, Illinois, announces appointment of T. F. Hudgins & Assoc., Inc., Houston, Texas, as their exclusive representative in the states of Louisiana, Alabama and Mississippi. T F. Hudgins & Assoc., Inc. will replace Fred M. Erichson, New Orleans, Louisiana, who resigned as representative for the Nugent Company.



ELIMINATES SERIES-PARALLEL SWITCHES

SPRAG CLUTCH DRIVE operates with non-chamfered ring gear. Pinion indexes on spiral spline, positively engaging ring gear before power is switched on. Engagement of the pinion and ring gear is maintained during intermittent or sporadic engine firing.

HEAVY BRUSH INSPECTION PLATES resist damage from use and handling—are sealed to prevent leakage.

Engine manufacturers are invited to write directly to Delco-Remy for complete information and engineering assistance on the specific application of these new motors.

Fleet owners should specify this motor for new trucks through their truck dealers.

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electrical systems

GM GENERAL MOTORS

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GM Distributor

Spokane Diesel, Inc. of Spokane, Wash., a newly organized firm with Ray E. Bisterfeldt as president and Fred Schillinger as secretary-treasurer, has been appointed distributor for the Detroit Diesel Engine Division of General Motors. The firm, now reorganized as a Detroit Diesel "Engine House", will handle sales and service for Detroit Diesel products throughout eastern Washington and ten adjoining counties in northwest Idaho.

Purolator Manager

Appointment of Eugene B. Delaney as manager of manufacturing for Purolator Products, Inc., Rahway, N. J., has been announced by the manufacturer of filters and filter systems. Mr. Delaney will have direct responsibility for all company manufacturing operations at Rahway. This position was previously held by Justus P. Nesbitt who is retiring. Mr. Delaney joined Purolator in 1947 and in 1958, he was advanced to general manager of Purolator's Wayne (Mich.) Division, the position he held until his present appointment.

Hundreds of successful Hydrojet installations have proved their value in daily operation!

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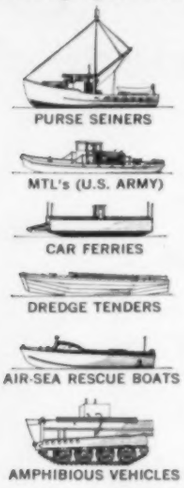

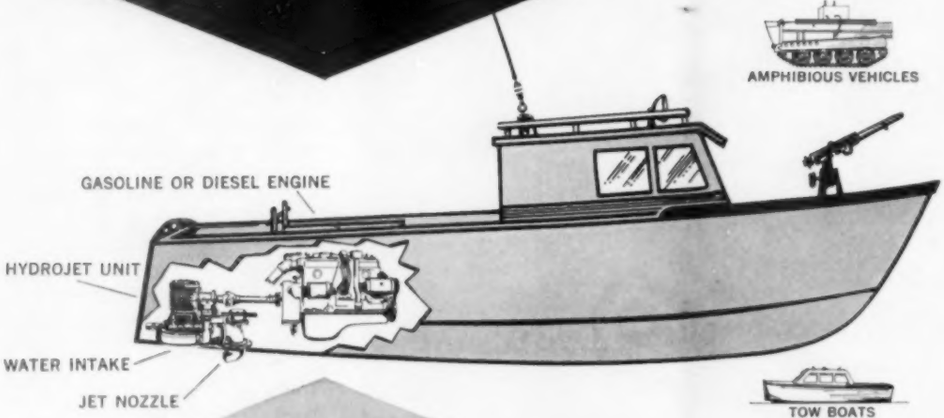

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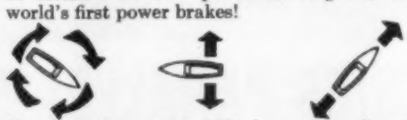
Marine propulsion enters the jet age with Hydrojet . . . the proven reliable water jet system. No more propellors, rudders or shafts . . . no clutch, no reverse gear. Self-contained Hydrojet units provide *propulsion and steering* for craft up to 65 feet in length . . . with lower operating cost and greatly reduced downtime. Hydrojet bow steering is available for ships or large vessels using conventional propulsion.

Hydrojet gives you instant full power, with constant thrust efficiency over the entire speed range regardless of load conditions. Hydrojet *extras* such as integrated high pressure water systems and power bilging are available with most units.

UNSURPASSED MANEUVERABILITY!

Hydrojet provides full power operation ahead or astern . . . 360° power steering and the world's first power brakes!



You can stop, or turn 180°, in your own length at full speed . . . maintain complete maneuvering control at low speeds, or back in any direction . . . and operate in shallow or debris-filled water with no fouling.

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Distributor and dealer opportunities open in certain areas

Exide Broadens Line

Exide Industrial Division of The Electric Storage Battery Co. has added nickel-cadmium batteries to its line of industrial storage batteries. The new batteries, having nickel- and cadmium-oxide active materials contained in perforated steel pockets of the positive and negative plates, are offered by Exide for use in a number of specialized applications where this type of battery sometimes is a superior power source. These include starting engines to generate emergency power, emergency lighting systems, switchgear tripping in electric utility substations, stand-by to assure continuous operation of microwave systems, and, emergency communications and safety equipment in marine service. The new line is available in 22 electrical sizes, with eight-hour capacity ratings ranging from 10 to 450 ampere-hours, and in other special types and sizes. The active materials of the battery plates are contained within pockets formed from perforated, nickel-plated, annealed steel strips that are folded and flanged together. The filled strips are fitted into nickel-plated steel frames to form plates having great mechanical strength. Hard rubber separator rods insulate plates of opposite polarity while maintaining reservoir space for electrolyte at the power-producing surfaces. Further information about Exide nickel-cadmium batteries can be obtained from Exide Industrial Division, The Electric Storage Battery Co., Rising Sun and Adams Ave., Philadelphia 20, Pa. (ITS NEW)

English Firm To Make, Sell Winslow Filters

An arrangement with Powell-Duffryn Ltd. of London, England, calling for manufacture and sales of Winslow filters throughout the British Isles, has just been announced by Laurence L. Moore, president of Winslow Engineering and Manufacturing Co. of Oakland, Calif. Powell-Duffryn has interests in shipping, mining, manufacturing, petroleum, wood pulp and other varied fields. The company plans to begin manufacturing Winslow oil and fuel filters in a plant oustide London in the near future. Initial sales distribution will cover England, Scotland and northern Ireland. Winslow also has a plant in Epernay, France and a special European representative in Vevey, Switzerland.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.

Mid-West Diesel News

By **L. H. Houck**

SEVEN International diesel tractors for the Central Soya Co., Fort Wayne, Ind., and assigned to its Chattanooga plant. Engines are Cummins, transmissions RoadRangers, 2-speed Timken axles.

INLAND GM Diesel, Inc., Milwaukee, has delivered an 8V-71 GM diesel power unit to the Manitowoc County Highway Department for use on a Cedarapids crushing plant.

CUMMINS NT-380 to N. R. Hamm Construction Co., Perry, Kan., for repowering a LeTourneau-Westinghouse model B Tournapull. Delivery by Cummins Kansas City Diesel Sales Corp., Kansas City, Mo.

LETOURNEAU-Westinghouse rock hauler, a new unit recently introduced, to Nelson Bros. Quarry, LaHarpe, Kan., with Cummins diesel.

ATCHISON-Topeka Hospital, Topeka, Kan., model NVH 12, 175 kw Cummins generator set from Cummins Kansas City.

ALLIS-Chalmers HD-11E with Allis-Chalmers HD-516 diesel engine to Ray Reynolds, St. Louis county, from Ryan Equipment Co., St. Louis.

TO John Bodine, St. Louis county, Allis-Chalmers HD-16DC with Allis-Chalmers model 16000 diesel from Ryan Equipment Co., St. Louis.

ARING Equipment Co., Milwaukee, a GM 5043-7101, which is General Motors new 4-53 engine, from Inland GM Diesel, Inc., Milwaukee. To repower a Michigan 85A loader.

CUMMINS C-180 B diesel for repowering an International R-200, to Orscheln Bros. Truck Lines, Moberly, Mo.

BYERS Portabase Co., Chanute, Kan., has installed a Cummins C-180 in an IHC R-195. Unit from Cummins, Kansas City.

BRUCE Marble Co., Fort Scott, Kan., a Cummins, NHRIS-6 to repower a 150 kw GE generator, from Cummins Kansas City Diesel Sales Corp., Kansas City, Mo.

LEHIGH Portland Cement Co., Chanute Kan., now has 20 White 9000 trucks in its fleet with Cummins diesels.

J. A. Tobin Construction Co., Kansas City, is operating 15 IHC heavy duty trucks with Cummins diesels, on a road job near St. Joseph, Mo.

SIX Euclid 27 ton bottom dumps with GM 6-110 diesels to Fruin-Colnon-Utah Construction Co., largest pumped storage electric plant in the world being built by Union Electric Co., near Taum Sauk Mountain in southeast Missouri.

SIX Koehring Dumptors, 10 yd., with 6-71 GM diesels, to Fruin-Colnon-Utah Construction Co., joint venture, $20 million construction job for Union Electric Co., near Lesterville, Mo.

MISSOURI Portland Cement Co., Sugar Creek, Mo., a pair of new model LeTourneau-Westinghouse rock haulers with Cummins diesels.

SANTA Fe Hospital, Topeka, Kan., model HRC4 Cummins diesel, 50 kw generator set from Cummins, Kansas City, for emergency standby service.

GRAVES Truck Lines, Kansas City, Cummins diesel, model NHE-195 for repowering a tractor, from Cummins, Kansas City.

CUMMINS C-160-B for repowering a truck to John Stark Quarry, Girard, Kan., from Cummins, Kansas City.

ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

CAN YOU PICK THE RINGS WITH 37,000 HOURS' WEAR?

UNRETOUCHED PHOTOGRAPH

Take a close look at this engine piston that's just been pulled for routine inspection at the generating plant of Illinois Rural Electric Co. Then see if you can pick the rings with 37,000 hours of wear.

No matter which ones you picked, you're right! The *complete set* of Cook rings has completed 37,000 hours of operation. But you wouldn't know it.

What's the reason for the unusual wearing qualities of this set? Special, expensive *top* rings? No, they're standard Cook sealing rings. The reason is to be found in grooves number 4 and 5 — COOKTITE sealing rings. Cooktite rings completely seal the ring gap, ring groove, and cylinder wall, and greatly reduce the excessive load normally carried by ring number 1.

Maybe Cooktite is the solution to your ring problem.

HAVING TOP RING TROUBLE?

If you have had trouble with your top piston rings (excessive groove wear, groove damage, ring breakage, etc.) you won't need to be convinced that the top ring carries from 50 to 80% of the sealing load. The solution that is saving dollars for many companies is the installation of a Cooktite sealing ring, or rings, in the lower grooves.

In an engine with a compression pressure of 500 psi and a firing pressure of 1,000 psi, a Cooktite ring will reduce the pressure differential on the top ring from a trouble-causing 750 psi to an easily-handled 500 psi. Ask a Cook representative to show you where Cooktite rings can work for you.

SEND FOR FREE 6-PAGE BOOKLET

When should piston rings be replaced? Proper planning of piston ring replacement cuts fuel and cylinder-wear costs, and prevents piston and liner damage. You can get a free copy of this informative technical study. Just write: C. Lee Cook Division, Dover Corporation, 940 South 8th St., Louisville 3, Ky.

C. LEE COOK

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EMD Engineering Promotion

H. L. Smith, Jr.

H. L. "Pete" Smith, Jr., has been named assistant chief engineer of Electro-Motive Division, General Motors. Smith's new position includes responsibility for end product design, including locomotive design, export and production drafting groups. He joined Electro-Motive in 1946 as a detail project engineer and became locomotive section engineer in 1959.

14 Yd. Euclid Scraper

Euclid Division of General Motors has announced full production of a new twin-power scraper of 14 cu. yds. struck capacity and 20 yds. heaped SAE rating at 1:1 slope. Designated as the model TS-14, this all-wheel drive scraper is powered by two GM 4-71 engines totaling 296 hp and each with a separate Allison Torqmatic Drive consisting of torque converter and 4 speed semi-automatic

transmission. Air assist remote control and full power shift enables operator to change from one speed range to another by a simple flick of the wrist to move the selector lever. No-Spin differential is standard in both drive axles. Tires are 24.00 x 25. Two hydraulic jacks provide full 90 degree steering. Scraper operations, bowl, apron and ejector, are hydraulically and independently controlled. The ejector is of the positive roll out type actuated by a hydraulic jack that is identical to the apron jack. All-wheel drive, as proved in the big 24 yd. Euclid "Twin," gives this new scraper a wide range of usefulness. Descriptive literature and detailed specifications are available from the Sales Promotion Department of Euclid at Cleveland 17, Ohio. ITS NEW

New Diamond T Diesel With 90 Inch BBC

New tractor of Hixson Truck Line of Akron, Ohio, is Diamond T model 990 with Cummins NHE-195 diesel engine, Timken FD901 front axle, Eaton 1911 rear axle, Fuller R960 RoadRanger transmission, Spicer 14 in. 2 plate clutch, Bendix-Westinghouse air brakes, Ross TE71 steering gear, Luberfiner 750C oil filter and Donaldson oil bath air cleaner.

Development of its new 990 diesel series is announced by Diamond T Motor Truck Co. The 990 has a 90-inch BBC dimension which enables it to haul a 40 ft. trailer within an overall length of 50 ft., with ample clearance even in full-jackknife turns. According to Diamond T, the 990's cab is roomy and uncluttered, has stretch-out room to spare for the huskiest pair of drivers. Accessibility is excellent. After removal of the quick-detachable fenders (in six minutes) and the one piece fiberglass engine compartment cover, the engine-radiator area is wide open for service. Numerous options permit custom-building each individual truck to meet the buyer's specific requirements. Gross combination weight ratings go to 78,000 lbs. Cummins diesel engines in the new 990 as follows:

ENGINE	HP	TORQUE	GOV. SPEED
NH-180	180	504 lbs. ft.	2100
NHE-180	180	535 lbs. ft.	1950
NH-195	195	535 lbs. ft.	2100
NHE-195	195	580 lbs. ft.	1950
NH-220	220	606 lbs. ft.	2100
NH-250	250	685 lbs. ft.	2100

In the new 990 diesel series Diamond T offers eleven main transmissions, from 4-speed to 12-speed, including the Fuller RoadRanger R96 and R960, and the Spicer Synchromaster. In addition, four auxiliary transmissions are regularly stocked production options. Aluminum cases may be specified on a number of these gear boxes. Ten rear axles of different types are available on the 990 series, in capacities from 22,400 to 29,000 lbs. They include single-speed and two-speed types, hypoid or spiral bevel designs. Front axles include the Rockwell-Timken FD901, rated at 9000 lbs., and the FE900, which is rated at 11,000 lbs. The 990 diesel is built as a tandem axle unit for over-the-road service, as well as for off-highway work, such as logging, dump, mixer and oilfield operations. Operators have a choice of eight tandem axles in a comprehensive selection of ratios; rated capacities of the tandems range from 34,000 lbs. to 50,000 lbs. Lightweight highway tandems, such as the Timken SLHD and the Eaton-Hendrickson 32M and 34DS, are customarily supplied in fast ratios suited for this application. Larger tandems, including the Eaton-Hendrickson 42M which is rated at 50,000 lbs., are offered in slower, high numerical ratios.

11th Annual Co-op Conference

The 11th annual conference of the Rural Electric Generating Cooperatives was held recently in La Crosse, Wis., presenting a program designed primarily for plant superintendents and operating personnel. Here are some of the men at the conference. Shown are, from left, top row Joseph E. O'Brien, REA, Washington; J. W. Magee, Westinghouse Corp., Philadelphia; L. H. Flanders, Factory Mutual Engineering Division, Norwood, Mass.; second row—R. L. Preston, Dairyland Power Cooperative, La Crosse; center—Robert Staten Federated Rural Electric, Jackson, Minn.; L. H. Poppa, Dairyland Power Cooperative, La Crosse; bottom row—John Schoen, Vern E. Alden Co., Chicago; W. E. Rushlow, REA, Washington, and N. W. Moser, Dairyland Power Cooperative, conference committee chairman.

Gould Sales Vice President

J. R. Tench

Appointment of John Robert Tench as vice-president in charge of sales of industrial batteries, Gould-National Batteries, Inc., has been announced. He succeeds Mr. M. W. Heinritz, former vice-president of industrial sales. Mr. Heinritz will remain with the company as a vice-president and will be associated with the Industrial Division in an advisory capacity. Prior to joining Gould, Mr. Tench was associated with Follansbee Steel Corporation and Blaw Knox Company.

Heads Reliability Division

K. D. Evans

Hercules Motors Corp. has announced creation of a product reliability division and the appointment of Keith D. Evans as division manager. The new division combines quality control, field service and engineering, inspection and testing into a major staff function, providing scientific control of quality on a company-wide basis. Mr. Evans has been with Hercules Motors for the past 18 months in the capacity of manager of quality control. He was previously associated with International Harvester Co. holding a variety of production management posts since 1941.

Alcoa Hosts SAE Tour

Aluminum Company of America played host on the opening-day session to some 280 members of the Society of Automotive Engineers, in Cleveland, Ohio, for the national powerplant meeting. Alcoa's part in the three-day program included an afternoon tour of its facilities, a panel discussion on aluminum fabricating, dinner, and a two-speaker evening technical session on stress analysis. In the early afternoon, chartered buses brought the visitors to Alcoa's Cleveland works—first, for a look at the operation of the U. S. Air Force's mammoth 50,000 ton forging press, operated by Alcoa adjacent to its own massive forging and casting facilities. More time was then spent in Alcoa's sand foundry, where inspection of a V12 cast aluminum diesel engine crankcase for a 750 hp tank capped a tour of the foundry's plaster department, core room, foundry and trim room. During the tour of Alcoa's sand foundry, SAE visitors saw the V-12 cast aluminum diesel engine crankcase in three stages of fabrication: (right to left) Rough casting before removal and trimming operations, rough casting after sand blasting, rough casting after trimming.

TWO NEW INEXPENSIVE ENGINE STARTING DEVICES

Tested and Approved by Major Engine, Construction and Farm Equipment Manufacturers*

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MODEL #962—for use with either 7 cc or 16 cc aluminum capsules

For Standby Generator Sets, we offer our Remote-Control Electrical Models #965 and #970, allowing peak power output within SECONDS after primary power fails.

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MINEOLA, NEW YORK

*Names on request

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DEPARTMENT 363

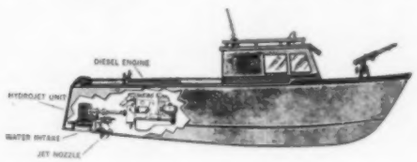
New Locomotive For Export

A newly-designed model is now being built by Alco Products, Inc. at Schenectady, N.Y. for passenger, freight and heavy transfer service in foreign countries. Known as the DL-541, it is an 1800 hp unit designed specifically to meet international clearances and axle loads encountered on foreign tracks. Powered by an Alco model 251, V-type, 12-cylinder engine and employing six multi-gauge traction motors, these new all-purpose locomotives have been equipped with many special features for foreign service. The unit shown includes a double-size fuel tank, a multiple-unit control which will permit operation from the lead cab of several DL-541's coupled together, vacuum brakes,

over-speed controls, speed recorder, and a vigilence control device, The cab arrangement of this new locomotive offers excellent visibility in both directions.

Form Water Jet Unit Firm

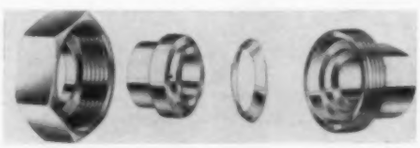
Hydrojet Marine Corp. has been set up in Cleveland, Ohio, to manufacture and market water jet propulsion systems for commercial and pleasure craft of all types, according to Paul T. Shirar, president. Mr. R. G. Skinner, formerly with Amphibious Boats, Inc., Denton, Tex., is vice president and Robert E. Potter Jr. is marketing director. The new corporation is licensed by Hanley Hydrojet, Inc., Prospect, Ohio, holders of Hydrojet patents, and has the exclusive manufacturing and sales rights for the commercial and military fields in the U.S.A. and commercial, military and pleasure boat applications internationally. The Hydrojet unit, which was developed by Keenan Hanley, a director of the new firm, is currently being applied to amphibious vehicles for the Armed Services, and to various types of commercial and pleasure craft up to 65 ft. in length for propulsion and steering. Powered by a diesel engine, the

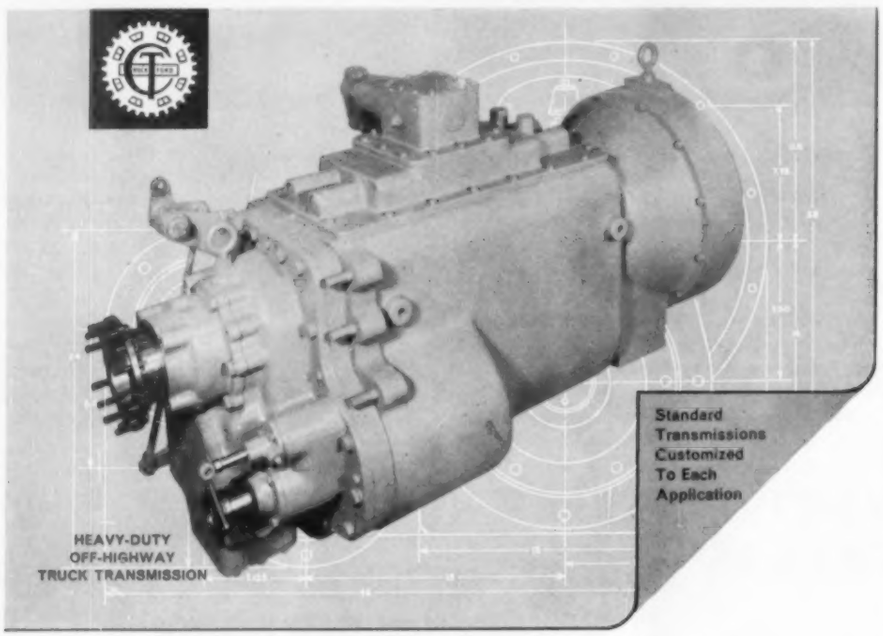


Hydrojet unit operates like an efficient pump—taking water in, giving it velocity and ejecting it to produce motion. Maneuverability is rated excellent and according to Hydrojet engineers, a boat so equipped can stop in its own length, turn in its own length, and back in a straight line or any desired direction under perfect control for any distance. Another feature is that of complete maneuvering control at extremely low speeds. Models to be marketed by the firm range from 1,000 to 2,500 lbs. of thrust, and in the near future are expected to exceed 5,000 lbs. of thrust.

New Tube, Pipe Fitting

Development of a new type of tube and pipe fitting for small diameter sizes from ⅛" to 1" tube o.d. has been completed by the Marman Division of Aeroquip Corp. This new Conoseal® union fitting is an adaptation of Marman's standard Conoseal sealing principle. Designed to withstand extreme low or high temperatures and high pressures or vacuum where leak-proof sealing is a requirement, this new all-metal fitting assures dependable sealing without leakage on applications with temperatures ranging from –450° F. to +1500° F. and pressures up to 16,000 psig. The union fitting is particularly suited for joining critical pneumatic, hydraulic or fuel lines, cooling and heat transfer lines and pressure or vacuum lines. It can also be used as a transition joint to connect dissimilar metals. Normally all components are stainless steel to prevent corrosion. A copy of Bulletin 804 with complete engineering details and performance capabilities is available by writing Aeroquip Corp., Marman Division, 11214 Exposition Blvd., Los Angeles 64, Calif. ITS NEW





Solve your heavy-duty power problems with Cotta heavy-duty transmissions

Is full engine power out of reach for your machine because the gearbox can't handle heavy-duty loads? Cotta power transmission *specialists* can customize standard transmissions to meet your individual heavy machinery requirements: multiple speeds, forward and reverse, space limitations, continuous day-and-night operation, weight, and mounting.

150 to 2,500 ft-lb input torque capacities

Cotta takes over where standard transmissions quit . . . in 100 to 750-hp ranges . . . in capacities from 150 to 2,500 ft-lb input torque. For half a century, Cotta "engineered-to-order" transmissions have been leaders of power to profit on drilling rigs, rock crushers, pumps, power shovels, locomotives, generators, and other equipment demanding long hours of trouble-free operation in the field.

Diagrams sent free on request

See our catalog in *Sweet's Product Design File*. Check the detailed descriptions and specifications on standard and custom applications. Then call Cotta (TWX-RK-7720 or phone WO 4-5671) for details on precision-built transmissions designed especially to handle your heavy-duty power problem.

COTTA

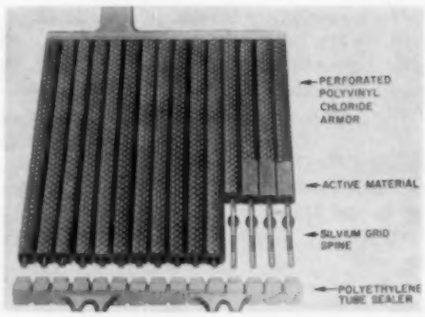
Pumping Locomotives Construction Drilling

HEAVY-DUTY TRANSMISSIONS

COTTA TRANSMISSION CO., ROCKFORD, ILLINOIS

Exide Industrial Battery

Exide has boosted electrical power of its industrial storage batteries for stationary service by 66 per cent and more in introducing a positive-plate design that is unique in the application. The innovation, a tubular-type plate, has been incorporated in a new battery called the EHGS Exide-Ironclad for use in electric utility, telephone, microwave, emergency lighting and power, fire alarm, police telegraph and laboratory service. Exide states the battery will last an estimated 20 years in float-charge service, and cost considerably less per ampere-hour per year than conventional Planté—and flat-plate stationary batteries. Exide has adapted to stationary applications the latest design of its tubular-type positive plate. After laboratory and field testing of many types and sizes of tubular positive Ironclad batteries for telephone, electric utility and railway signaling applications, this battery now is available for commercial use. A battery of similar construction recently was removed for tests and analysis from a substation of a large electric utility company. It had performed switchgear and standby power and lighting service for 16½ years. Even after this time in field operation, the battery still had more than 100 per cent of its rated capacity. The good condition of the lead-antimony positive plates indicated that the battery would have given



many additional months of useful service. The patented Exide Silvium grid alloy introduced about six years ago promises to extend expected life of this tubular-design plate in float service, making 20 years a conservative estimate, Exide states. The new tubular positive plates of the EHGS, with the patented Silvium grids, are 30 to 60 per cent thicker than those of other stationary batteries with flat pasted plates. Teaming with the new EHGS positive to deliver full power at high discharge rates are pasted negative plates that are 9 to 20 per cent thicker than those of any other type of stationary battery. The EHGS Exide-Ironclad, assembled in a transparent polystyrene jar, is available in ten sizes, with capacities at the eight-hour rate ranging from 200 to 800 ampere hours. More information on the EHGS Exide-Ironclad for stationary applications can be obtained from Exide Industrial Division, The Electric Storage Battery Co., Rising Sun and Adams Ave., Philadelphia 20, Pa.

ITS NEW

Honor Henry Ortner, Jr.

Henry Ortner Jr., service engineer of American Bosch Arma Corp., Commercial Sales Division, is shown in accompanying photo receiving his 35 year service pin and gold watch from Ralph L. Countryman, vice president and division manager (right). Henry Ortner started with American Bosch in July 1925 as a magneto assembler. Several years later he was transferred to the repair and service department and with another company technician, Max Poellman, in 1927 demonstrated the first diesel equipped truck in the U. S. in a cross country tour. During World War II, he served American Bosch as a technical representative to Boeing and the U. S. Army for the gasoline injection system used in B-29 bombers. As service engineer for American Bosch, Mr. Ortner has become well known in diesel circles and has held hundreds of fuel injection schools and clinics in the United States and Canada.

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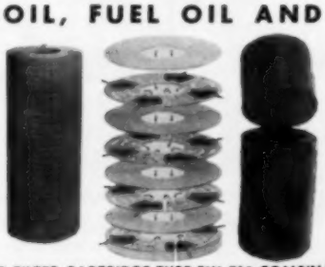
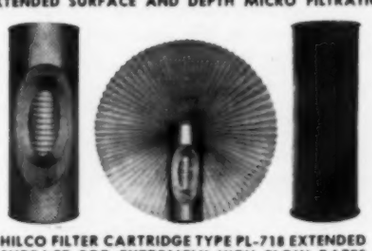


HILCO FILTER CARTRIDGE TYPE FW-718 COMBINATION EXTENDED SURFACE AND DEPTH MICRO FILTRATION



HILCO FILTER CARTRIDGE TYPE PL-718 EXTENDED SURFACE FOR EXTREMELY HIGH FLOW RATES

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THE HILLIARD CORPORATION
122 WEST FOURTH STREET
ELMIRA, NEW YORK

Florida Diesel News

By Ed Dennis

THE Minute Maid Corp. is currently using, in developing a new citrus grove west of Fort Pierce, two model 98 Link Belt Speeder one yard draglines powered with GM 4-71 diesels plus two 68's with 3-71 GMs and one Austin Western super 100 grader with a GM 3-71 and Allison torque converter. The 3-71 diesels are rated 90 hp at 2100 rpm.

UP at Jacksonville, the Duval Engineering & Contracting Co., was using a Caterpillar D6 dozer (85 hp) for pushloading a Caterpillar DW21 two wheel tractor 25 yard No. 470 scraper. It is powered by a six cylinder turbocharged 300 hp Cat diesel.

FOR Latin American Div. of Pan American Airways another self propelled Hobart motor generator, for the modernization program in their jet ground support. The Hobart, 60 kva 120/203 volt 173 amp 400 cycle 1714 rpm generator, is powered by a model C-160-BI Cummins diesel engine.

AT Flor-A-Mar, near New Port Richey, we counted five Le Tourneau Westinghouse model D rear dumps. These are powered with 145 hp General Motors 4-71 diesel engines.

THE newly launched *M. V. Floridian*, a 360 foot container ship owned by the Erie & St. Lawrence Corp., has for main propulsion, two DMR 38 eight cylinder four cycle Enterprise diesel engines each rated 2100 shp at 290 rpm. Also included are Brown-Boveri turbochargers and intercoolers.

AN Allis-Chalmers TL-20 D tractor loader is being used at the Davenport Sand Co. near Winter Garden to haul sand and rock to a mixing plant for road bed material. This unit is powered by an Allis-Chalmers D-516 diesel rated 130 hp at 2200 rpm, Allison transmission and single stage torque converter.

AN International Harvester tractor, model TD-9, rated 66 hp, with a Drott Skid shovel for the Big Chief Demolition Corp. of Fort Lauderdale and a TD-15 International crawler tractor, also with a Drott unit, for Flor-A-Mar, New Port Richey; from Florida-Georgia Tractor Co.

THOSE 77 new White 5000 highway tractors that Great Southern Trucking is taking delivery of are powered with Cummins model NHE-195 diesel engines (195 hp at 1950 rpm), have Fuller transmissions plus Perry water filters.

OVER near Orlando, the Cambron Construction Co. was using a Hough one yard Payloader tractor shovel powered with a six cylinder 94 hp Hercules diesel engine for road construction work.

RECENTLY purchased, for use on their citrus groves, an Oliver Lugmatic No. 995 tractor with a GM 3-71 diesel and Allison torque converter, to pull a Be Ge Rotohaul dirt scraper, by the Minute Maid Groves, west of Fort Pierce.

THE San Marco Contracting Co., in reconstructing Highway 27 near Clewiston, is using two Michigan 280 tractor dozers. These are powered by Cummins turbocharged, model NTO-6-BI, diesel engines each rated 262 hp at a governed 2100 rpm. Both have Clark torque converters and transmissions.

THE Gulf Coast Engine Sales of Tampa, sold a one cylinder Lister model LD marine diesel engine for installation in a Honduran fishing boat. This 3x3½ in. diesel has a rated bhp of 3½ at 1800 rpm.

THE Sumner-Sollitt Co., operating near Port Richey, has two portable air compressors each powered by GM 6-71 diesel engines. The units, one a Gardner-Denver model 600 and the other a Jaeger rotary air compressor, supply air to dynamite drill rigs mounted on Caterpillar tractors.

A Waukesha model DKB 135 powers the 175A Michigan tractor shovel the Austin Co. is using near Port Tampa. This six cylinder, 4¼x5 in. diesel develops a max hp of 133 at 2200 rpm, has a Clark torque converter and transmission plus a 2¾ yd. bucket.

THE Municipal Electric Power Plant of the City of Stark is now using natural gas in the five VDSS8 Superior diesel generating units. Also included in this beautiful installation are 1250 kva, 1000 kw, 300 amp, 240 volt Electric Machinery generators, Elliott turbochargers Hilco Hyflow oil filters and a Westinghouse switchboard.

THE Jacksonville Br. Detroit Diesel Div. repowered a GMC truck with a 4-71 diesel (156 hp at 2300 rpm) using the original transmission, for F. L. Hiers, Jacksonville; and a similar model in a Mack B42, using the Mack transmission, for the Greenville Lumber Co. of Greenville.

THE Lancing Rock Co. of Brooksville is currently using, in their "rip and push" method of mining, two D8 Caterpillar tractors, one has a ripper the other a dozer blade plus a Bucyrus-Erie 54B 2½ yard shovel powered with a Cat D 337 diesel. The latter has a 310 hp rating at 2000 rpm.

MODERN Diesel Power of Florida at Tampa has installed a model DD 172 cu. in. Ford Diesel in a racing car. By removing the gyro counter balance weights the diesel clocked 5000 rpm on the dry test runs. Total weight of the car is less than 1000 lbs. and Al Hawver expects to do about 90 mph on the quarter mile track.

THE Jacksonville Br. of Detroit Diesel Div. G. M. supplied two G. M. (4-71) dieselized Delco 40 kw generating units for a fishing vessel built at the Bellinger Shipyard.

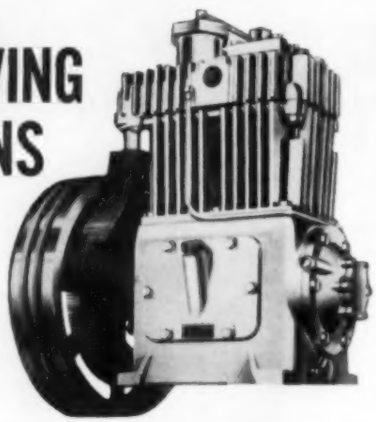
AT Boynton Beach, the Consolidated Development Corp. is developing a $22 million housing development of approximately 1000 homes. Two Caterpillar 619-442 tractor scrapers with 225 hp turbocharged Cat diesel engines and 14 cu. yd. capacity along with Cat D8 series H dozers are helping to move about 450,000 yds. of material.

Couplings Bulletin

Two new types of Dodge Para-flex flexible cushion couplings, one for high speed, high torque applications and another for attachment to flywheels of internal combustion engines, are described in a new 20-page bulletin. Engineering data, photographs, dimension drawings and selection tables cover the new high speed and flywheel couplings as well as the original standard Para-flex with its tire-shaped flexing member of cord and rubber construction. All three of these flexible cushion couplings are designed to accommodate angular and parallel shaft misalignment and end float, to absorb vibration, and to cushion shock loads. Flanges are furnished with taperlock bushings for fast and easy mounting on shafts. Request Bulletin 901 from Dodge Manufacturing Co., Mishawaka, Ind. (ITS NEW)

starting power . . .

FOR MOVING MOUNTAINS



Quincy COMPRESSORS

When the job is earth-moving, Quincy Compressors are there to start the big diesels for the day's work. Air power delivered by Quincy is low cost, dependable.

Service is available across the country—around the clock.

Models from 1 to 90 CFM. *Write for catalog.*

QUINCY COMPRESSOR CO., Dept. DP160, Quincy, Ill.

Makers of the World's Finest Air Compressors

Rotary Actuator Catalog

A new line of hydraulic rotary actuators for slow speed, high torque drive mechanisms, turbine control systems and a range of other commercial applications is described in detail by a 16 page catalog just issued by Houdaille's Buffalo Hydraulics Division. Called HYD RO AC, this new family of rotary actuators includes five different sizes. The torque range of these standard units goes all the way from 1500 to 702,000 in. lbs. at 3000 psi. The operating pressure ranges from 250 to 3000 psi. The units achieve an efficiency of 95 per cent or over, with a very low starting (friction) torque. They are well suited for servo system use, being highly responsive. In addition, they can provide angular travel up to 280° and can be foot or end mounted. Other special units and other configurations will continue to be available on custom orders. For a copy of the Houdaille HYD RO AC catalog, write Houdaille Industries, Inc., Dept. S, 537 East Delavan Ave., Buffalo 11, N. Y. (ITS NEW)

New Filter Element

Commercial Filters Corporation has developed a sintered 316 stainless steel filter element adaptable to any CFC Fulflo filter. The porous metal element is designed for the filtration of particularly corrosive, high temperature and high viscosity fluids. The elements are available in uniform 40, 20, 10, 5 and 2 micron particle-retention ratings and according to CFC are free from media migration under high differential pressures, vibration or thermal shock. The elements can be cleaned by firing, chemical or ultrasonic treatment or back flushing. Product Bulletin S713 is available on request. Write Commercial Filters Corp., 2 Main St., Melrose 76, Mass. (ITS NEW)

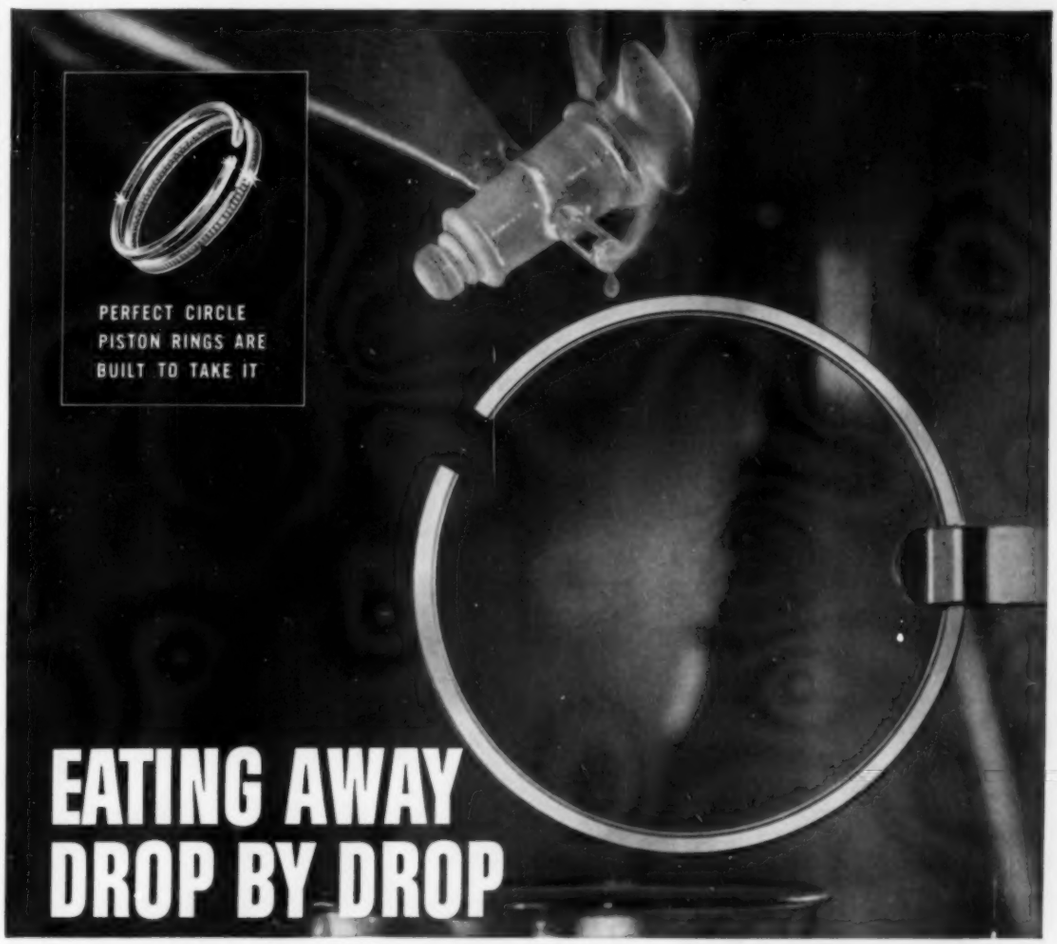
Pershing Support Turbine

Ground support for the Army's new Martin-built Pershing missile will be provided by small gas turbine engines, designed and produced by The Garrett Corporation's AiResearch Manufacturing Division, Phoenix, Ariz. The Martin-Pershing support system marks the first Army adoption of the AiResearch dual power package concept in use by many of the world's commercial jet lines. The new Pershing system is a light-weight, track-mounted replacement for the Redstone missile. Readily transported to unprepared sites, it can be erected and fired in a matter of minutes, under the Army's new "shoot and scoot" concept. In a compact, turbine-driven package the AiResearch Pershing unit provides all missile ground power requirements including air conditioning. Equipment driven from a four-pad gear box provides ac, dc and high pressure air, plus low pressure pneumatic power from the turbine's compressor section. Based on commercial aircraft support units, the new air transportable military version was developed on short delivery schedule. First of the AiResearch units has been shipped to Martin-Orlando.

C-B New York Office

The Cooper-Bessemer Corporation's New York District office, and the office of the corporation's International Division, have moved to a new location in Manhattan's business district. Their new address will be 548 Fifth Avenue, New York 36, N. Y., in the Seamen's Bank for Savings building.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.



Moisture and acids formed by combustion can eat away piston rings, much as they eat away mufflers and tailpipes.

Perfect Circle protects against this corrosive wear with extra-thick, solid chrome plating. For abnormally corrosive applications, special alloys are also used. And, Perfect Circle rings are even specially protected from corrosive skin acids during production, packing and installation.

Perfect Circle rings are built to take the toughest engine wear. Insist on Perfect Circles—the most preferred piston rings in all the world.

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HAGERSTOWN, INDIANA • DON MILLS, ONTARIO, CANADA

West Coast News

By James Joseph

TO Vinnell Corp., Alhambra, Calif. contractors, two Murphy MP-20 diesels for powering Palmer 100 kw generators, on Mexican project.

REPORT issued by Western Highway Institute, shows 11 western states now have 40 per cent of nation's trucks, 20 per cent of its diesel trucks, though only 18 per cent of vehicles (including cars), nationwide.

TO Connolly Pacific Co., Long Beach marine contractors, a Quincy model 390 air compressor driven by an HB-2 (24 hp at 1800 rpm) Lister-Blackstone diesel. Sale: Bolstad Sales & Service, San Pedro, Calif.

CONSOLIDATED Rock Products Co., Los Angeles, has taken delivery on 10 Mack dump trucks powered with Cummins NH-220 diesels, the double trailer units to stockpile rock and gravel.

TO Matich Bros., Colton, Calif., 11 Challenge-Cook Bros. center dump rigs with Cummins C-175 engines. Sale by Los Angeles' Cummins Service & Sales.

TRANE Co. has purchased six American Marc AC-2 engines (13 hp at 2000 rpm) to direct drive undercar railroad refrigeration compressors, the set-up to be tested by four major U.S. railroads.

FOR offshore drilling, three 400 kw Caterpillar D397 diesel electric sets (with turbo and aftercooling), for Pacific sites. Sale by Shepherd Machinery Co., Whittier, Calif.

DOUGLAS Oil Co. of California's yacht *Observer* is being installed with two FR-4 Lister-Blackstone watercooled diesels driving 20 kw generators.

DELIVERED: to Riverside Cement Co., Riverside, Calif., 16 Kenworth center dump trucks with Cummins NH-220 diesels, for bulk-cement delivery.

ENGINE standardization program at Douglas Aircraft Co., Inc., sees conversion of four Kenworth tractors from Cummins NHS-6 (290 hp supercharged) engines to NH-250s, and three new Kenworth rigs installed with NH-250s.

TO Diamond Bar water system, two Caterpillar D342 (150 hp at 1200 rpm) natural gas engines for driving deep well turbine pumps.

ELLIOTT Rock & Concrete Co., in California's San Fernando Valley, has repowered a gas-engine White Mustang truck with a Cummins JNS-6 (supercharged, 175 hp at 2500 rpm).

REPOWER: R. V. Shaffer, Downey, Calif., has repowered a GMC 503 truck with a Cummins C-175, a gasoline-to-diesel conversion.

AS standby electrical set for Mira Loma Hospital, in California's Antelope Valley, a Caterpillar 300 kw diesel electric unit with D397 as motive power.

TO Watson Bros. Transportation Co., 11 Mack tractors powered by Cummins NH-250 diesel engines.

CHARLES Kle Wing, Los Angeles, has installed a Lister-Blackstone SL-2 (12 hp at 2000 rpm), 2:1 ratio, as auxiliary propulsion in his sailing yacht *John Hanna*.

MONTE-Copter, Inc.'s new tri-phibian helicopter (operates on land, water and in the air) is jet-air powered by a Continental model 141 turbine engine driving an air compressor. Certification trials are scheduled soon in Seattle, Wash.

TO Pacific Marine Terminal Co., Los Angeles, a Volvo MD-1, 5 hp at 2000 rpm.

TUNNEL testing in California: Avro ground effect craft, designed by Canada's A. V. Roe Ltd. Rumor says saucer-shaped hover craft is powered by turbine engine.

BOEING Airplane Co., Seattle, which claims sales of more than 1000 of its gas turbine engines (for trucks, boats, and to drive generators, compressors and pumps), expects to market its most powerful small turbine yet—the 520-2 with a bhp of 400—in late 1961.

Waterways Data Book

Transportation lines and their vessels operating or available for operation under the American flag on December 31, 1959 on the Mississippi River system and the Gulf Intracoastal waterway, are described in a 397 page book published by the Board of Engineers for Rivers and Harbors, Corps of Engineers, U. S. Army. It is now available at $2.25 each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Three comprehensive tables are provided. "Transportation Lines on the Mississippi River System and the Gulf Intracoastal Waterway 1960": Table 1 lists 1,025 transportation lines (companies or individuals) with their addresses. Table 2 lists each vessel, its type and construction, type of operation, net register tonnage, length and breadth, draft, horsepower, carrying capacity, highest fixed superstructures, cargo handling equipment, local operating base, and date built or rebuilt. Table 3 shows service, the localities served by the vessels, the schedules of operations, principal commodities carried, the usual navigation season, and the railroads having joint rates with water carriers at ports where the information was available.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.

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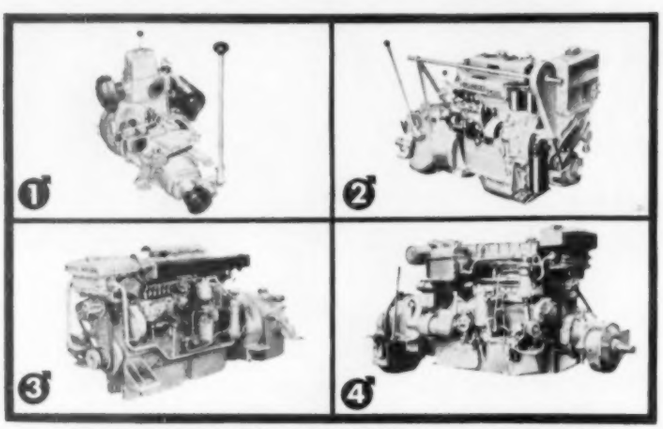
VOLVO MARINE DIESEL ENGINES

Swedish engineered and built... for the world's worst weather

For over 50 years working fleets have ruthlessly tested these sturdy, superbly-made Volvo Marine Diesels . . . from the Arctic to the Tropics. Now available coast to coast in 8 stock sizes from 5 to 185 hp., they offer record-holding power for commercial use. ❶ MD 1—dependable power for small boats and auxiliaries. ❷ 1113BR—a true heavy-duty diesel for the most rugged use in small work or fishing boats. ❸ MD47—a light-weight, compact, high-output engine for smaller work and fishing boats. ❹ TIMD 96—turbo-charged with inter-cooler for high power with low weight. Dependable choice for heavier work boats and ocean-going fishing boats.



VOLVO MARINE DIESEL ENGINE SPECIFICATIONS — 4 CYCLE—WATER COOLED

Model	H.P.	Displ. cu. in.	R.P.M.	Cyl.	Weight lb.
MD-1	5	27	2000	1	285
1052-BR	28.2	136.8	1800	2	1325
*1113-BR	55.5	230.8	2000	3	1300
*1114-BR	74.5	307.7	2000	4	1640
*MD-47	83	287	2500	6	1470
*MD-67	103	410	2400	6	1765
*MD-96	137	585	2200	6	1985
*TIMD-96**	185	585	1800	6	2205

*Available with different gear boxes. **Turbocharged with inter-cooler

Write for complete data on entire Volvo line of marine diesel and gasoline engines, sales and service.

VOLVO IMPORT INC.

Dept. DP-11 452 Hudson Terrace, Englewood Cliffs, N. J.

GM Boat Show Exhibit

Diesel engines for practically every type of boat from 22 feet were displayed in the Detroit Diesel Engine Division exhibit at the 1961 National Motor Boat Show at New York's Coliseum. Included were engines in the Division's "53," "71" and "110" series ranging from 35 to 675 hp in a wide variety of "in-line," "V" and "inclined" models. Three Series 53 engines for small pleasure craft and work boats include a two-cylinder in-line unit of 35 continuous horsepower for both propulsion and auxiliary power, a three-cylinder in-line model of 97 horsepower, and a matched pair of 130 horsepower four-cylinder inclined units. According to the Division, the inclined model display reveals the low silhouette of these engines and their highly favorable size, configuration and hull-hugging characteristics. For medium size craft the Division displayed a pair of 195 horsepower six-cylinder engines. These are Series 53 "V" models measuring less than 50 in. in length. For larger pleasure craft and work boats, the Division presented a representative showing of its "71" and "110" models. These are "in-line" and "V" engines ranging from 252 to 675 horsepower. Included were a Series 71 six-cylinder "in-line," eight, twelve and sixteen-cylinder "V" models, and an in-line six-cylinder "110."

New LeT-W Grader

The LeTourneau-Westinghouse Co. of Peoria, Ill., has announced availability of an new motor grader, the model 330-H. This is a 100 horsepower unit, with the choice of power from either the GM 3-71 or the Cummins V-6-BI engines. The 330-H utilizes a heavy-duty constant mesh transmission with eight forward speeds up to 23.6 mph. Creeper gears are available as low as ¼ mph. The four reverse speeds range from 1.7 to 12.2 mph. Weights, with standard equipment, are 21,690 pounds with GM engine and 22,090 pounds with the Cummins. The engine is rubber-mounted to eliminate vibration to the frame, which is an all-welded, one piece unit, with the strength to use the full power of the engine. A wide range of optional equipment and accessories are available for use with this machine.

ITS NEW

Perkins Marketing Saturn

Perkins Gas Turbines Ltd., a subsidiary of F. Perkins Ltd., is now marketing the U. S.-built Solar gas turbine—the 1250 hp Saturn, suitable for many military and industrial applications. Perkins has exclusive rights to manufacture and sell throughout Europe, Africa and the British Commonwealth, excluding Canada, all gas turbines produced by Solar Aircraft Co., of San Diego, Calif. The 1250 hp unit can be used, as a propulsion unit for fast boats, as a power source for electric generators, as a ground support unit for advanced jet aircraft, and for many types of pumps for flood water control, product pipeline pumping, or mobile equipment. The two shaft variable speed version provides a "torque converter" effect giving quick acceleration, maneuverability and positive emergency stops.

Nordberg Appoints Two

Appointment of George J. Wooldridge as Sales Engineer and Alden G. (Al) Wiedenhoefer as service engineer in the Great Lakes district under Mr. Philip Wallach, district sales manager in the Cleveland office was announced by R. W. Bayerlein, vice president, Engine Division, Norberg Mfg. Co., Milwaukee, Wisconsin. George Wooldridge has been with Nordberg since 1956 where he served in various sales, engineering and production departments in a specialized training program for this assignment. Al Wiedenhoefer joined Nordberg in 1935 and has served the company in various capacities including for a time that of New York District service engineer.

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The one replacement pack that can deliver 7,000 to 12,000 miles of proven superior filtration. Makes possible fewer oil and pack changes and extended maintenance schedules. Based on cost per mile, IMPERIAL DIESELPAK is the most economical replacement pack you can use.

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Michigan-Ohio News

By Jim Brown

MICHIGAN Tractor & Machinery Co. of Detroit has installed one of the new Caterpillar truck engines, which were recently announced in Caterpillar's expanded line of diesel engines. The Caterpillar model 1673 (rated at 220 hp) was installed in Michigan Tractor's own Mack B-80, and is reported to be giving good service and economy while delivering heavy machinery throughout the state of Michigan.

DETROIT office of Wolverine Tractor & Equipment Co. recently delivered two International model TD-15 crawlers to the City of Detroit. The new crawlers were equipped with winches and will be used by the Dept. of Public Works.

ANGELO DiPonio of Detroit has accepted delivery on a model 440 ICD John Deere crawler tractor. The new crawler is equipped with a hydraulic 'dozer blade and powered by a GM 2-53 diesel engine. The sale was made by R. G. Moeller Co. of Detroit.

AN Allis-Chalmers HD11E crawler tractor with hydraulic 'dozer blade was recently sold to Kuebler Excavating Co. of Ann Arbor, Michigan by Earle Equipment Co. of Detroit.

AN International model TD-9 with a Drott 4-in-1 attachment was recently delivered to the City of Essexville. The unit will be used primarily on a sanitary land-fill operation and was purchased from Wolverine Tractor & Equipment Co.

CUMMINS Diesel Michigan Inc. of Dearborn, Mich. has installed a Cummins model C-160-B engine in a Diamond T model 660 tractor. The installation was done for Horton Motor Service of Grand Rapids, Mich.

REDFORD Township, Michigan recently purchased a John Deere 440 ID (wheel-type) ½-yd. loader with a backhoe attachment. The unit is powered by a GM 2-53 engine and was sold by R. G. Moeller Co. of Detroit.

INGHAM County Road Commission in Michigan has recently accepted delivery on an Allis-Chalmers model HD11B with hydraulic bulldozer blade. Sale was by Earle Equipment Co.

A Hough model H-90D Payloader powered by a Cummins C-175 was recently purchased by Ed Kauthen of Wayne, Mich. Sale was made by Wolverine Tractor & Equipment Co., Detroit office.

A Cummins model NH-250-B was recently installed in an Autocar for Eugene Howes of Kaleva, Mich. The diesel engine was purchased from Cummins Diesel Michigan Inc. of Dearborn, Mich.

RAYMOND Excavating Co. of Marysville, Mich. has accepted delivery on a John Deere model 440 ICD equipped with a model 63 dozer blade and model 300 side boom. Powered by a GM 2-53 diesel engine, the unit will be used for pipeline construction. Sale was by R. G. Moeller Co.

THE Sanitation Dept. of the City of Detroit has accepted delivery on an Allis-Chalmers model HD16 with hydraulic bulldozer and torque convertor drive. The new crawler was purchased from Earle Equipment Co.

SAIRALL Trucking of Wyandotte, Mich. has accepted delivery on an International TD-6 with a Drott 4-in-1 attachment. The sale was made by the Detroit office of Wolverine Tractor & Equipment Co.

CUMMINS Diesel Michigan Inc. has installed a Cummins model C-180-B diesel in an International model R-190 truck. The installation was done for Lester Morton Trucking Co. of Tiffin, Ohio.

RAY D. Baker of Detroit has accepted delivery on a John Deere model 440 ICD equipped with a model 300 side boom and powered by a GM 2-53 diesel engine. Michigan distributor of John Deere construction equipment is R. G. Moeller Co.

AN Allis-Chalmers model TL-40 front-end loader (wheel-type) was recently delivered to Anthony Gushow of Auburn, Mich. Sale was by Earle Equipment Co.

TELFORD Equipment Co., Inc. reports delivery of a Bucyrus-Erie model 30-B backhoe powered by a GM 4-71 diesel engine. The new B-E will be used in excavating work on sewer projects by Golcheff Bros. of Mt. Clemens, Mich.

TED Vaughan of Caro, Mich. has accepted delivery on an International TD-20 equipped with hydraulic 'dozer blade and Drott rake attachment. The new crawler was purchased from the Detroit office of Wolverine Tractor & Equipment Co.

ROY Hudson, a broker from Petosky, Michigan has a new NH-220-B Cummins diesel in a model LJ Mack truck. The installation was done by a branch office of Cummins Diesel Michigan, Inc.

Starting Aid Brochure

Just off the press is Phillips Manufacturing Company's new four-page brochure covering the Zero Start ether diesel starting fluid injectors. The new, brochure illustrates two Zero Start starting fluid injectors, models E600 and E700, and their installation, plus the complete line of Zero Start electric engine preheaters, headbolt, tank-type and dipstick types. To secure a copy, write to Phillips Manufacturing Co., 8200 Grand Ave., South, Minneapolis 20, Minn. ITS NEW

The perfect trio...

. . . for the Diesel repair shop. Provides the necessary equipment for running essential tests on injection units and for re-conditioning injector nozzles.

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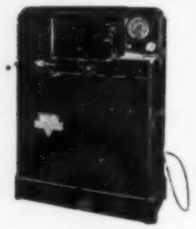
For testing and calibrating all types of fuel pumps . . . provides utmost accuracy . . . rapid and easy to operate . . . combines rugged modern design.



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Meets every demand of fast, accurate nozzle testing. Permits precise observation of entire nozzle action and spray pattern. Single dial records time and pressure readings. New injector receiving clamps eliminate pipe connections.

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Simplified Hose Style Guide

The A-to-Z of industrial hose style selection is now charted in an easy-to-read alphabetically arranged booklet, Bulletin 627, released by Aeroquip Corp. The booklet serves as a guide for proper hose selection for virtually every industrial application. Listed are 112 separate liquids and gases, beginning with acetate solvents and ending with zinc salt solutions. The suitability of various tubestocks for use in carrying these diverse agents is charted in four separate classifications: excellent; good; conditional; unsatisfactory. The charts indicate tubestock suitability only; a separate chart in the forward part of the booklet provides fundamental information about the pressure, temperature, and size limits of the individual hose types. The 12 page booklet is an excerpt of information already appearing in Aeroquip Industrial Catalog 250, also recently released. It was prepared as a handy, smaller guide for use by maintenance supervisors and designers primarily concerned with hose selection problems. Request Bulletin 627 from Aeroquip Corp., Jackson, Mich.

ITS NEW

Plan New Headquarters

Robertshaw-Fulton Controls Co. has exercised an option to purchase six acres of property in Henrico County, suburban Richmond, Va. on which it will build a two-story structure to house its corporate headquarters. Thomas T. Arden, president of Robertshaw-Fulton, said the firm will build an office building which will more than double the working area presently leased by the company in downtown Richmond.

Gear Drives Catalog

Application, selection and order information for the new line of "radicon" enclosed fan-cooled worm gear drives recently introduced by Foote Bros. Gear and Machine Corp. are detailed in a new catalog. The booklet covers AGMA standards, details application data, selection and ordering procedures, AGMA load classifications and service factors, rating tables, and permissible overhung and thrust loads and much other pertinent data. Copies of Engineering Catalog RCB may be obtained from Dept. MJ, Foote Bros. Gear and Machine Corp., 4545 S. Western Blvd., Chicago 9, Ill.

ITS NEW

Hose, Fittings Chart

Users of fluid power can obtain new 21" x 32" two-color Wall Chart just released by Anchor Coupling Co. Inc. a quick, ready-reference for the firm's reusable hydraulic hose, couplings and fittings. The wall chart enables fluid power users to easily find the catalog numbers of the Anchor reusable products shown. In addition, Anchor has released a new 10 page, envelope-size leaflet giving highlights of their complete hydraulic hose, couplings and fittings for replacement use. Copies are available by writing direct to Anchor Coupling Co. Inc. 342 North 4th St., Libertyville, Ill.

ITS NEW

New Continental Office

Continental Motors Corp. has opened West Coast offices at 3402 Century Blvd., Inglewood, Calif., in support of its manufacturing customers in that area, C. J. Reese, president, announced this week. The new office is staffed to furnish engineering assistance as well as field follow-up.

READY NOW! The completely new 1960 edition of the **DIESEL AND GAS ENGINE CATALOG,** Volume 25, can now be purchased. If you design, purchase, sell, operate or service diesel, dual fuel, or gas engines, the Catalog is essential to you and your business. This giant, 442 page, 10½ x 13½", fully illustrated reference book has been rewritten, revised and brought up to date completely from cover to cover and costs just $10 postpaid anywhere in the world. Send checks, money orders or company orders to **DIESEL AND GAS ENGINE CATALOG,** 9110 Sunset Blvd., Los Angeles 46, Calif.

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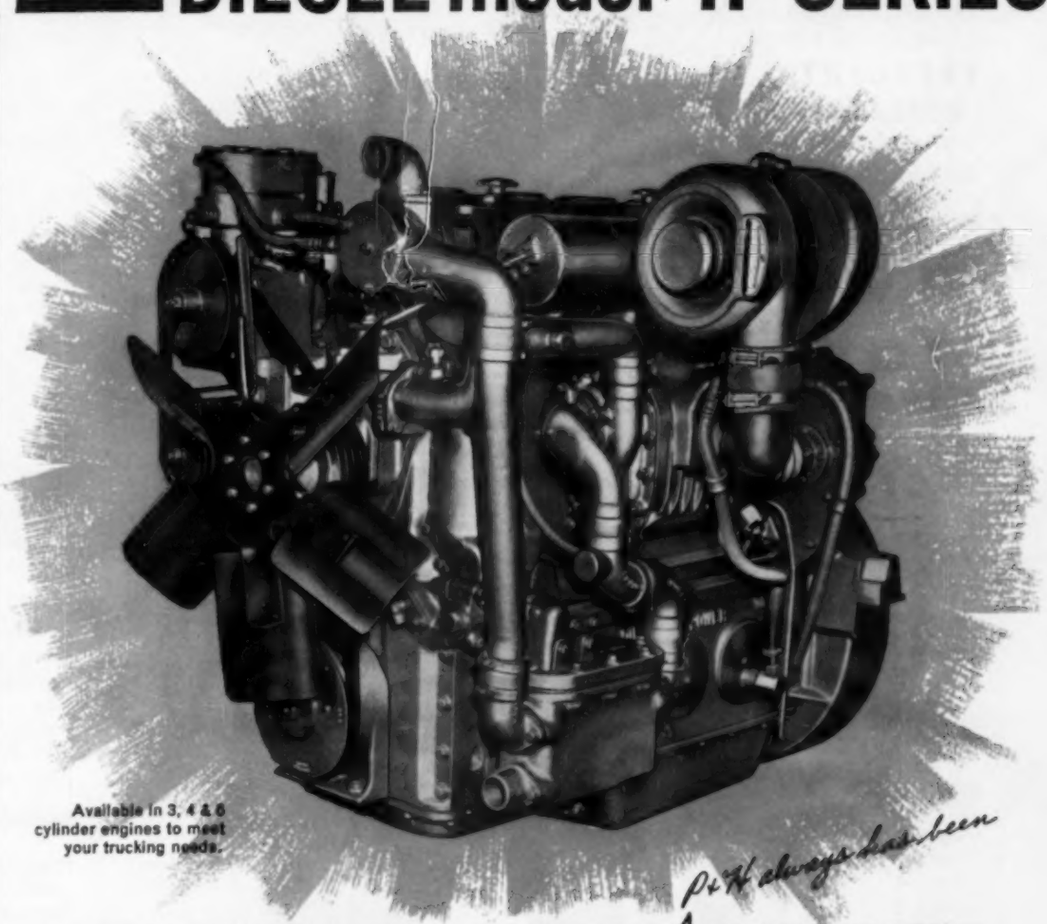

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Briggs Jet Fuel Filter Applied on River Towboats

Availability of a jet aircraft type unit for processing diesel fuels for towboat and marine service has been announced by the Briggs Filtration Co. Designated the BFS-15-V filter/separator, the unit was originally developed by Briggs in conjunction with military and oil company engineers to meet the flow, pressure and altitude requirements of fuels used in jet aircraft. Developed was a coalescent type cartridge of pre-densified spun glass that met every government specification. Now a cartridge of this basic design is the heart of the BFS-15-V unit. According to Briggs engineers, the unit has a rated performance of 99 per cent removal of dirt in particles one micron and over and 99.9 per cent removal of free water. The BFS-15-V is equipped with a sight gauge to indicate the amount of water collected in the sump, even though it is recommended the unit be drained daily.

The first Briggs filter/separator was installed early in 1960 on the J. D. Streett & Co. towboat *M/V Cape Zephyr* which is powered by three JS-8 Cooper-Bessemer diesels rated 810 hp at 450 rpm. According to Lawrence Head, the towboat company's port engineer, the unit has proved out highly satisfactory, eliminating previous maintenance problems. In addition to the *Cape Zephyr*, a similar unit is installed on the generator engines of another large towboat, plus several applications on manufacturers test equipment.

In the right foreground is the Briggs BFS-15-V filter/separator serving the three Cooper-Bessemer diesels on the *Cape Zephyr*. In the background is one of the three Briggs D-10-BR-H1 full flow filters.

Amot Appointments

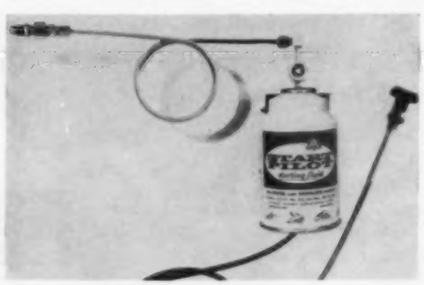
J. E. (Speed) Glidewell, formerly vice-president of engineering at Hall-Scott Motors, has been appointed chief engineer of Amot Controls Corp., Richmond, Calif., according to an announcement by Elton B. Fox, Amot president. In another announcement made at the same time, Harold P. Johnson, formerly associated with the Ross Heat Exchanger Division of American-Standard, was named sales engineer for the California firm which manufactures thermostatic valves for the engine industry. Mr. Glidewell has long been associated with the engine industry as an officer in the SAE. Mr. Johnson was western district sales manager for Ross before joining Amot.

J. E. Glidewell

H. P. Johnson

Aerosol Starting Fluid Primer

Start Pilot Corp. is manufacturing aerosol can primers which can be used with all brands of aerosol can starting fluids, and can be installed on the instrument panel or under the hood. With the installation of this engine primer, model 1200, the starting of the engine becomes a one-man operation, as it can be accomplished by the driver from his operating position. (ITS NEW)



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4-Cycle — AIR-COOLED — Single Cyl. 2 to 4½ BHP — 2000 3000 RPM. LIGHT WEIGHT — EASY STARTING. Especially recommended for PORTABLE & EMERGENCY EQUIPMENT
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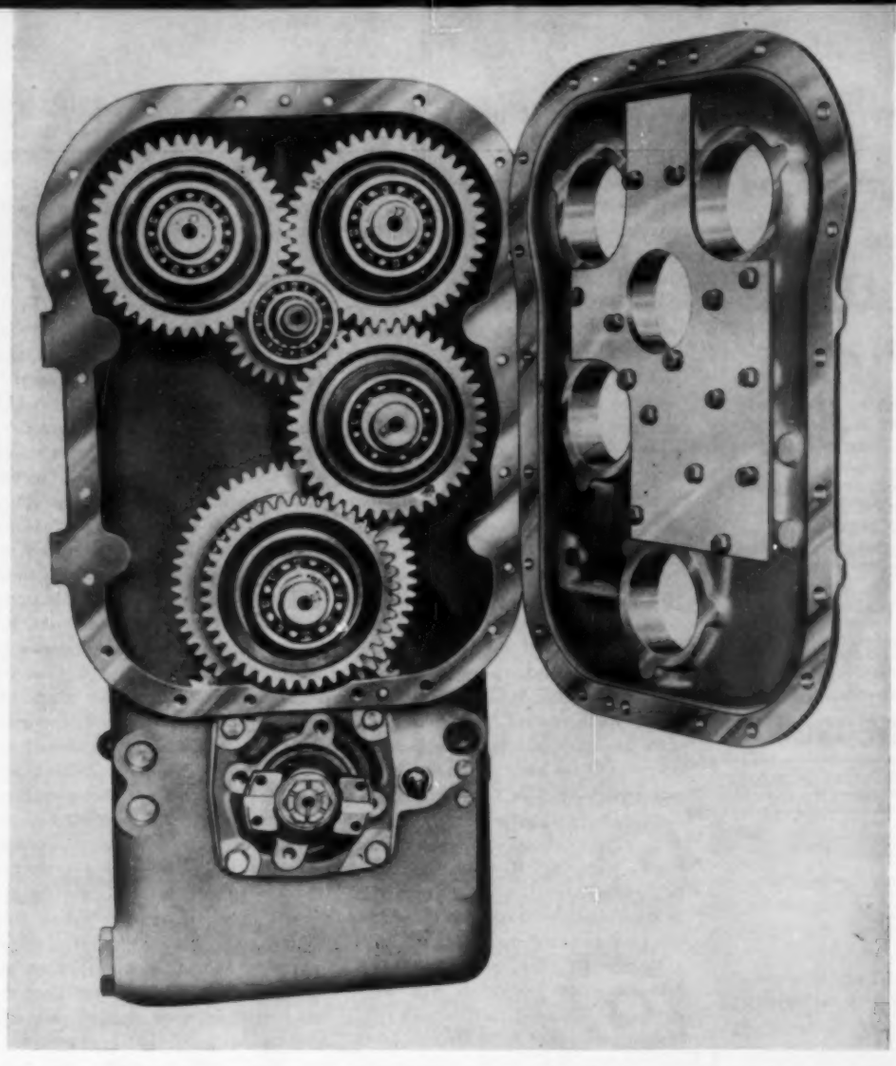


OFF-ROAD UNIT WITH POWER SHIFT

QUANTITY production of a new power-shift transmission for off-road vehicles has started at Clark Equipment Co. in Jackson, Mich. It was designed for the small machines that are built to do a big job. Designated the 2000 series, the new transmission (at left) is designed for use with the Clark 270 series torque converter. It will be used with diesel engines of approximately 200 lb. ft. of torque output in several new lines of front end loaders, rollers and lift trucks. Clark engineers say other potential applications include motor graders, tractors and other construction vehicles.

Major feature of the design is a system of four hydraulic clutches. These make available two speeds forward and two reverse, fully power shifted. A manual range selector is used, providing for four speeds in each direction. Reduction ratios are 4.78 and 2.53 in the two lower gears and 1.31 and 0.69 in the higher gears. The transmission is lubricated by the torque converter oil and serves as the sump for the converter. Hydraulic power to operate the clutches is supplied by a pump mounted on the torque converter. Two more pumps may be mounted on the converter to provide hydraulic power for auxiliary operations.

The transmission is adaptable for either two or four wheel drive with output shaft 17 in. below the input shaft.

NEW GRADED DENSITY FILTER FOR FUEL AND LUBE OILS

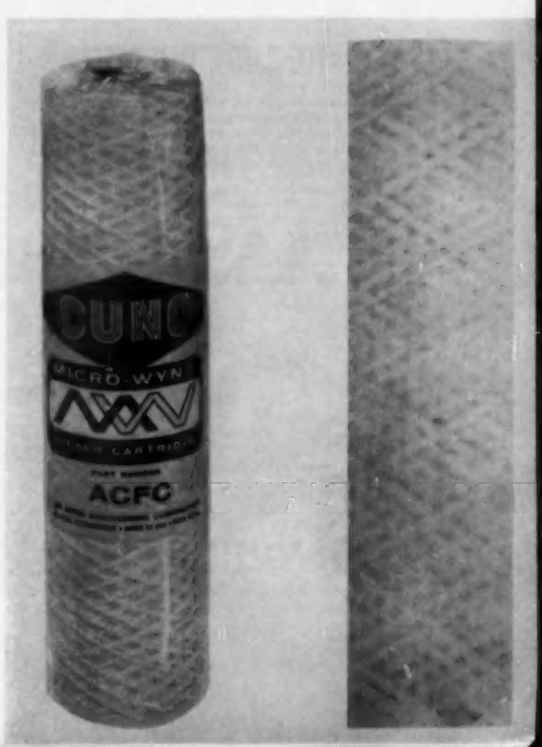
A NEW filter cartridge called Micro-Wynd, which is designed for service on almost all types of automotive, stationary and marine diesel engines, is now being produced by Cuno Engineering Corp., a subsidiary of American Machine & Foundry Co. Designed for both fuel oil and lubricating oil filtration and available in 10, 25, 50 and 75 micron densities, the new unit measures 1 x 2½ x 9⅞ ins. and fits all standard housings.

According to Cuno engineers, body strength and dimensional stability coupled with high flow rates, great contaminant capacity and long service life are the important features of the Micro-Wynd cartridge. Two materials used in its production, and a new winding process is utilized that provides excellent balance between filtering properties and structural rigidity. A technique is employed that scientifically integrates a layer of fibers known for its filtering properties and a yarn chosen for its strength. These two materials are separately, but simultaneously laid down around a heavy gauge stainless or tin steel core. The filter fibers then become uniformly interlaced as the winding yarn is applied under predetermined high tension.

Close-hand inspection of the new Micro-Wynd cartridge shows that in this manufacturing process, the filter fibers are woven in and out, completely bridging each diamond. This, according to Cuno engineers, provides controlled dispersion of fibers which enables the new unit to trap progressively finer contaminant particles from outside diameter to the core, and to maintain consistent flow rates with minimum risk of loading. There is no change of winding pitch, or number of diamonds around regardless of rated density. Ends of the Micro-Wynd cartridge are wound square with the core axis which allows any number of units to be assembled end-to-end in tiered arrangements without intermediate sealing devices. Typical ratings for a 10 micron Micro-Wynd cartridge (Code ACFC) are as follows:

Clean Fuel Oil (60 SSU) . . 4gpm at 2psi pressure drop
Clean Lube Oil (150 SSU) . . 2gpm at 2psi pressure drop

Cartridges are separately labeled, wrapped and sealed. Cartons are labeled for inventory control.



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MECROME
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Special Projects Engineer

Appointment of Warren Rhoades as design engineer for special projects in the development division of engineering has been announced by The Cooper-Bessemer Corporation. Mr. Rhoades was field sales representative for the corporation's southwest marketing district with headquarters in Dallas, Texas. He was formerly a service engineer in the Mount Vernon service department of the company. Mr. Rhoades has a wide background of field problems and customer relations. Among his accomplishments is the patent development of the air-fuel ratio controller used on Cooper-Bessemer four-cycle gas engines.

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FUEL AND LUBE OIL PUMPS

All of the qualities you want for smooth, positive delivery of fuel oils, lube oils and other petroleum products are combined in the Viking 288 pump. It is compact, quiet, easily serviced, delivers 17 to 164 G.P.M. and more, under pressures up to 200 P.S.I.

This pump comes in 4 sizes, each with 5 gear reductions, making it extremely versatile to fit your every need. Send today for complete information on the Viking 288 pump!

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Compact
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Positive Delivery
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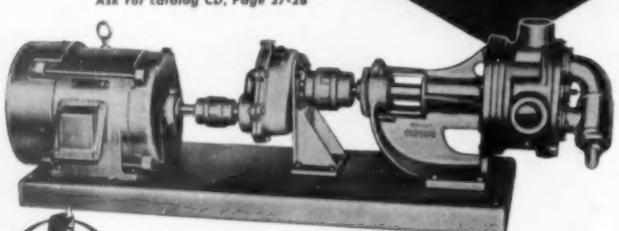
Quiet
•
200 P.S.I.

Ask for catalog CD, Page 27-28



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Cedar Falls, Iowa, U.S.A. • In Canada, It's "ROTO-KING" Pumps
See Our Catalog In Sweet's Industrial Construction and Plant Engineer's File

Cummins Filter Element

Cummins Engine Co. has announced the introduction of a new lubricating oil filter element for 750 and 500 cu. in. by-pass type filters. This element, designed and manufactured by Cummins, features special construction for extra strength and rigidity, high quality media for a uniform, efficient filtration, and extra large perforations for uniform oil flow. Filter media used in the new Cummins element is prepared and processed by Cummins through special methods which will insure a uniform mixture throughout the element. This element contains no additive removing chemicals, and it is, therefore, suited for compound oils. (ITS NEW)

19 Lines Use Firms Units

Nineteen U. S. and foreign airlines are now using AiResearch small gas turbines for commercial jetliner starting and ground power. The commercial units are stationed at 114 locations around the world, according to a recent report by The Garrett Corporation's AiResearch Manufacturing Division, Phoenix, Ariz. In the United States, including Hawaii, AiResearch turbines are in action at 59 airports in 28 states and the District of Columbia. Largest domestic customer for the units is Eastern Air Lines, now owner of 95 AiResearch truck-mounted and fly-away units. Abroad, AiResearch turbines are stationed at 55 airports in 43 countries. Largest single foreign customer for the AiResearch turbine starting and power equipment is Australia's Qantas Empire Airways, using 31. One AiResearch turbine, owned by Western Air Lines, operates just across Sky Harbor airport from its AiResearch Phoenix assembly line birthplace. Others are in use as far away as Turkey, Saudi Arabia, Thailand and Japan.

Danish Research Vessel

The Danish Ministry of Fisheries has had a new research and salvage vessel built and has fitted it with a B&W Alpha diesel engine. The vessel is intended to carry out experimental fishing and thus to pave new ways for the Danish fishing industry. Part of the year it will serve as salvage vessel, stationed in the Baltic. The new Danish research vessel was built by Svendborg Shipyard and bears the name of "Jens Væver" in memory of the inventor of the Danish seine. The vessel is built of steel according to the requirements of Danish legislation for fishing vessels with Northern European plying limits, and is a single-decker with raised poop, closed whale forecastle and four watertight bulkheads. The main dimensions are: length overall, 30.56 m; length b.p., 27.50 m; breadth moulded, 6.35 m. The 6-cylinder B&W Alpha diesel engine built by Burmeister & Wain's subsidiary company, Alpha-Diesel A/S, has controllable pitch propeller and develops 420/460 BHP. Trial speed was 10.5 knots.

Flexible Pump Connectors

Troublesome effects of pipeline vibration, misalignment, or thermal expansion in pump installations are absorbed or reduced by new "H.A.P." flexible pump connectors, introduced by Allied Metal Hose Co. Consisting of a short section of corrugated flexible metal tubing, protected against pressure elongation by wire braid, these pump connectors are furnished with threaded or flanged end connections to fit all standard piping sizes; and are available from ¼ through 16 in. in stainless steel, ¼ through 8 in. in bronze and hot-dip-galvanized steel, and ¼ through 4 in. in monel. Available in a wide range of standard stock configurations, the connectors are individually engineered to the specific application for optimum results. Material, lengths, and construction are varied to suit the conveyed fluid, pressures, temperatures, and movements encountered. In one typical construction, the flexible connector absorbs up to 3/8 in. high-frequency vibration amplitude, up to 1½ in. thermal pipeline expansion, and up to 4 in. permanent misalignment. "H.A.P." Pump Connectors handle pressures to 1500 psig, depending on alloy, braid construction and size. The safety factor of each hose unit is four times the rated working pressure. For more information on "H.A.P." flexible pump connectors, write to Allied Metal Hose Co., 8-14 38th ave., Long Island City 1, New York.

(ITS NEW)

New P & H Distributor

Appointment of the Equipment Service Co., Long Beach, Calif. as a distributor for P&H Industrial and marine diesel engines is announced by the Harnischfeger Corp., Pacific Division. Their territory includes the counties of Kern, Inyo, San Luis Obispo, Los Angeles, Orange, San Bernadino, Riverside, Santa Barbara and Ventura.

B-L-H Appoints Norton

Frederick H. Norton was named regional sales manager of the east central sales region of the Baldwin-Lima-Hamilton Corporation. The regional sales office is located at Pittsburgh, Pa. Mr. Norton joins B-L-H from Pittsburgh Forgings Co. where he was vice president for sales. Previously he had been vice president for sales of the American Car and Foundry division, New York, N. Y., of A. C. F. Industries.

Inland River Reports

By **A. D. Burroughs**

MYRTLE C., new 105x30 ft. towboat completed by Christy Corp. (Sturgeon Bay, Wis.), is in service under charter by S and S Marine Towing Co., Joliet, Ill. Twin GM engines supply the rated 1800 hp for performance on the Ohio and Mississippi Rivers.

THREE Caterpillar engines, D-343, are slated to provide the 900 hp for the new towboat to be built by Costa Co., Inc. The Omaha construction firm will use the triple-screw 65x25 ft. craft at points of waterway construction sites.

WHAYNE Supply Co., Louisville, furnished the 275 hp Caterpillar engine for the new *Janice R.* The tiny 10x20 ft. craft, owned and operated by Kentucky River Collieries, Inc., is specially designed for service on the Kentucky River.

MARINE Welding and Repair Works, Inc., Greenville (Miss.), has delivered the new 50x18 ft. towboat, *Ellen*, to owners Wayne Vahle, Inc. Two GM (Detroit) 6-71 engines provide propulsion power.

NEARING completion at Burton Shipyard, Inc., Port Arthur, Texas, is the 95x22 ft. crewboat. The triple-screw craft is equipped with GM (Detroit) engines for owner Caspery-Wendell Work Boats, Rockport, Texas.

THE new Jones' Offshore Boat Rental Service craft, *Tauri*, has been delivered by Saucer Marine Service, Inc., New Orleans. The 65x21 ft. utility boat is powered by two GM engines for the rated 660 hp.

TWO new Fairbanks-Morse engines have been installed on the *Chaperon*. The vessel was formerly known as *Sergeant Pryor* and performed for U.S. Army Corps of Engineers. Jeffersonville (Ind.) Boat and Machine Co. handled installation for the new operators, Brokamp and Bressler.

THREE 48 ft. utility boats and two 55 ft. tugboats composed the order delivered by American Marine Corp., New Orleans to Consorcio Puente Maracaibo, Venezuela. Construction of three additional tugs for the same South American firm is in progress at American Marine.

A new harbor boat, built by and for Material Service Corp., has been readied for final touches. The 40x16 ft. craft carries a Murray and Tregurtha unit for the 165 hp.

ENTERPRISE engine performance was observed when the *Toltec* was spotted in the Mississippi trade. Built in 1957 by Nashville Bridge Co., the 130x40 ft. towboat perfor..as with 3975 hp for Indian River Lines.

CHEMICAL STATE, a 1956 production from Calmes yard, was sighted at work on the Mississippi with 900 hp delivered from two Caterpillar engines. The 72x21 ft. towboat is owned by Capt. J. D. Cayton.

THE Bisso Ferry Company's *M/V Geo. Prince* is undergoing extensive enlargement and repowering at Avondale yards, New Orleans. Two GM (Detroit) engines will provide a power boost for the ferry to a rated 460 hp.

THE 140x35 ft. towboat, *Mike Creditor*, was busy in the Ohio coal traffic. Owned by Ohio River Co., built in 1955 by St. Louis Shipbuilding and Steel Co., the familiar craft has 2160 hp from two Baldwin-Lima-Hamilton engines.

THE *Eastern*, an outstanding towboat owned by Union Barge Lines, was frequently spotted at various points on the Ohio. The craft carries 3500 hp supplied by White Superior engines.

Studebaker Acquires Onan

Studebaker-Packard Corp., has acquired D. W. Onan & Sons, Inc., Minneapolis manufacturers of electric generating sets. Onan was Studebaker's fifth acquisition since late 1958. The firm had sales of $14,941,000 and net income of $1,945,000 before taxes in 1959. The transaction involved cash, common stock and a share of future earnings, Studebaker said. Onan will be run by its present management as a Studebaker division. In addition to generators, Onan makes power plants for emergency and marine use, some diesel and gasoline engines and other products.

Stamped Fastener Line

Crest Products, Inc., announces it has developed and is currently manufacturing four complete, new lines of stamped fasteners. The new Crest products include one-piece washer nuts, acorn nuts, regular nuts and wing nuts. They are produced by highly automated equipment, resulting in a low cost, quality product. The new Crest nuts are available in heat treated spring steel in all popular sizes and finishes. Crest also specializes in custom building fasteners to meet individual specifications. For further information, engineering assistance and samples, inquiries should be addressed to Crest Products, Inc., P.O. Box 64, Union, N.J. (ITS NEW)

Solar Army Contracts

Solar Aircraft Co. has received two new procurement contracts from the U. S. Army for units powered by its Titan gas turbine engine. The U. S. Army Ordnance District, Los Angeles, issued contracts for Army procurement of one Titan engine-powered auxiliary power unit for possible support of the Lacrosse missile and a Titan turbine-powered winterization kit for the M-60 tank. The turbine-powered generator powerpack for the Lacrosse is to be used in conjunction with the missile's mobile launcher. The Lacrosse is a close and general support weapon. Developed under the technical supervision of the Army Rocket and Guided Missile Agency, an element of the U. S. Army Ordnance Missile Command, it is designed to be used in close support of ground troops, supplementing air and artillery attacks on strong points in the field. The winterization kit for the M-60 tank will also include a Titan gas turbine-powered generator set and bleed-air heater unit. The unit will be used to start the tank's engine in cold weather. The M-60 is the Army's newest tank. Solar's Titan gas turbine engine weighs 52 pounds and develops up to 80 hp. It is 12½ inches in diameter and 25 inches long. Driving a generator, the turbine is capable of producing up to 45 kw.

9000 HP Turbine Brochure

New model 305-S single shaft gas turbine for mechanical and generator drive is presented in Bulletin 186, just released by Clark Bros. Co. Advantages such as simplicity, reliability, compactness and low first cost of this 9000 hp unit are discussed. A cutaway cross section plus detailed photographs highlight all important design features. Full dimensions and specifications are also included. Copies of Bulletin 186 may be obtained by writing to Clark Bros. Co., Olean, New York. (ITS NEW)

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ADVERTISERS' INDEX

AiResearch Manufacturing Division, The Garrett Corporation 14

Air Maze Corporation, The 4

Allis-Chalmers Manufacturing Co. 1

Bendix Corporation, The Scintilla Division 18

Bird-Johnson Company 9

Borg Warner, Rockford Clutch Division 13

Bosch Corporation, Robert 10

Briggs Filtration Co., The 59

C. A. V. Ltd. 12

Continental Machinery Co. 68

Cook Company, C. Lee 57

Cooper-Bessemer Corporation ..... Fourth Cover

Cotta Transmission Company 60

Dana Corporation 11

Delco-Remy Division, General Motors Corporation 54-55

Diesel and Gas Engine Catalog 7

Diesel Injection Sales & Service, Inc. 66

Eaton Manufacturing Co., Fuller Transmission Div. 20

Engineering Controls, Inc. 51

Fuller Transmission Division, Eaton Manufacturing Co. 20

Garrett Corporation, The AiResearch Industrial Division 14

General Motors Corporation Delco-Remy Division 54-55

Harrison Radiator Division 2

Harnischfeger Corporation 67

Harrison Radiator Division General Motors Corporation 2

Hydrojet Marine Corporation 56

Hilliard Corporation, The 61

International Harvester Co. 8

Interstate Diesel Service, Inc. 68

Kato Engineering Company 66

Koppers Co., Inc., Piston Ring Department 5

Luber-Finer, Inc. 65

M-C-M Machine Works Co. 68

Metal Finishers, Inc. 70

Murray & Tregurtha, Inc. 71

Nordberg Manufacturing Company 15

Perfect Circle Corporation 63

Quincy Compressor Company 62

Rockford Clutch Division, Borg-Warner 13

Rockwell-Standard Corp., Transmission & Axle Division ..... Second Cover

Schwitzer Corporation 19

Scintilla Division, The Bendix Corporation 18

Standard Oil Co., of California 17

Start-Pilot Corporation 59

Thomas Flexible Coupling Co. 72

Twin Disc Clutch Co. 16

Viking Pump Company 70

Volvo Import, Inc. 64

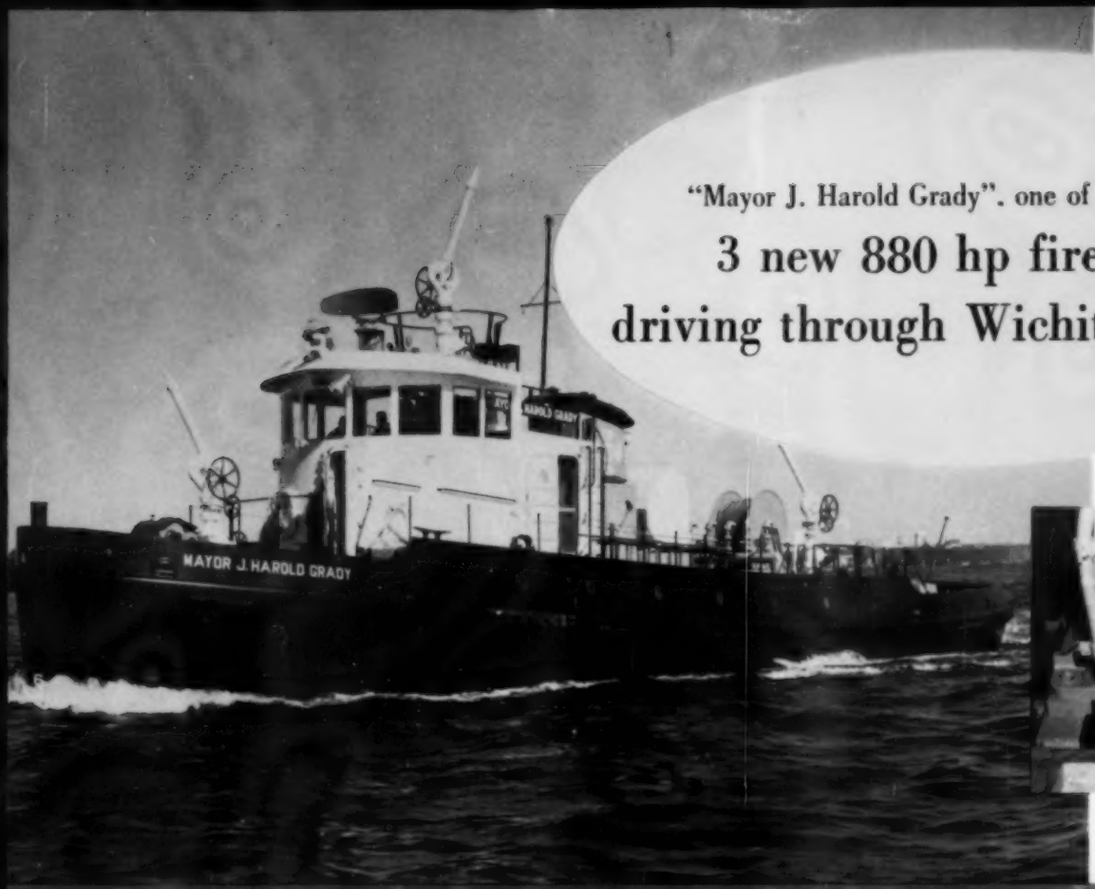
Western Gear Corporation 6

White Diesel Engine Division, White Motor Company 53

Wichita Clutch Company, Inc. ..... Third Cover

"Mayor J. Harold Grady", one of Baltimore's

3 new 880 hp fireboats driving through Wichita Clutches

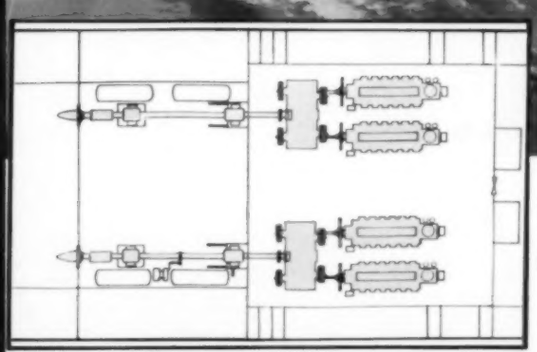


Wichita Clutch

"Patrick Calhoun, Jr.",

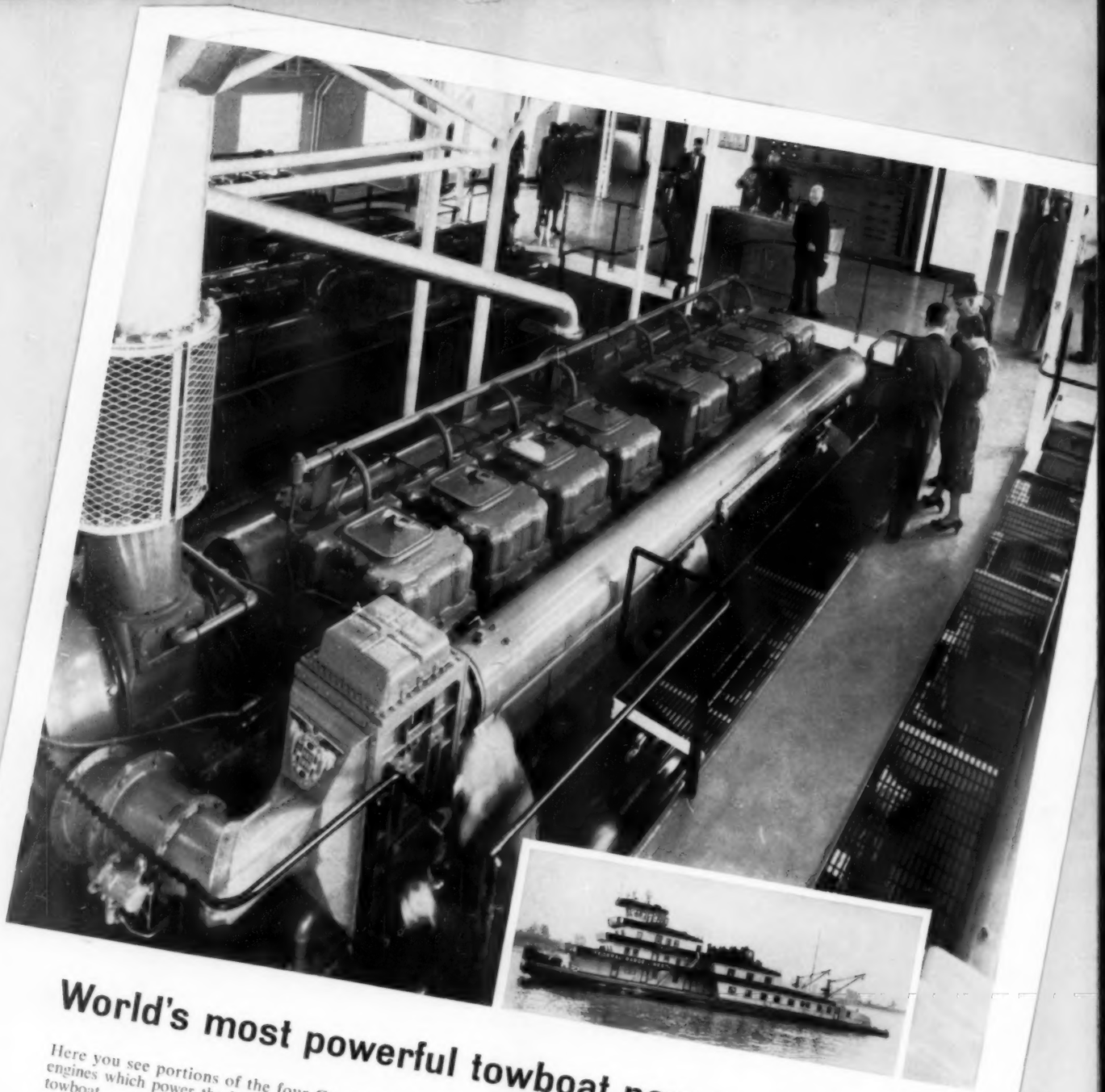
rated 6500 hp, one of two new Wichita Equipped

tow boats launched



. . . each towboat powered by a pair of twin 1655 bhp diesels driving through Wichita Clutches (shown in red)

WICHITA CLUTCH COMPANY, INC.



World's most powerful towboat now on the job

Here you see portions of the four Cooper-Bessemer engines which power the M/V America. This 9000 hp towboat . . . most powerful in the world . . . is now in operation for Federal Barge Lines, Inc. It was designed and built by St. Louis Shipbuilding & Steel Co., also builders of the M/V United States and the Austen S. Cargill (now under construction). These are the world's three most powerful towboats and they are all powered by Cooper-Bessemer engines.

The four Cooper-Bessemer engines for the M/V America are turbocharged LS-8 diesels, rated at 2250 hp. They are equipped with Vapor Phase cooling systems, supplied by Engineering Controls, Inc., and they will burn low-cost residual fuel oil. The towboat is designed for 24-hour per day duty on the Mississippi.

For the latest in engine advancements, check with Cooper-Bessemer when you start to plan. Call the nearest office.

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